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Volume XIX January-March 1984

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STUDIES IN THE HYALOSCYPHACEAE III: THE LONG-SPORED, LIGNICOLOUS SPECIES OF LACHNUM

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ABSTRACT

The tropical, long-spored, lignicolous species of *Lachnum* (=*Dasyscyphus, Erinella*) are revised. Nine taxa, including one new species, one new name and seven new combinations are described from type material. Sixteen additional types of species treated as synonyms were examined. More than 400 collections, many of which were made by the authors, were examined. The genera *Erinella* and *Erioscyphella* are lectotypified and *Dasyscyphella, Erioscypha,* and *Erinellina* are discussed. Lectotypes are also chosen for *Peziza leucophaea* Berk. & Curt., *Erinella subcorticalis* Pat., *Cenangium brasiliense* Mont., *Peziza simillima* Berk. & Br. and *Erinella cognata* Pat. An explanation is proposed for the large number of synonyms for these tropical taxa. A new combination is also proposed for *Belonidium chusqueae* Pat.

INTRODUCTION

Most temperate species of Hyaloscyphaceae have ascospores less than 15 µm in length, and those of many tropical species exceed 30 µm and may be as much as 130 µm. Several attempts to segregate these tropical species into a genus of their own has led to nomenclatorial and taxonomic confusion.

It is convenient to speak of "the long-spored tropical species of *Lachnum*" as if it were a well-defined taxonomic category, but spore length proves to be too unreliable to be the basis of sound generic distinctions. Even though many species are separated by differences in spore length, it is impossible to find a distinct break between the short-spored temperate species and the long-spored tropical ones. For example: the predominantly temperate *Lachnum apalum* (Berk. & Br.) Nannf. has spores distinctly longer, 35-45 µm, than those of the exclusively tropical *Dasyscyphus albidulus* var. *longisporus* Dennis which has spores 18-25 µm. In the opinion of the authors both of these species are congeneric with the type of *Lachnum* and also with the lectotype of *Erioscyphella* which is the nomenclatorially available name for "long-spored tropical species."

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REVIEW OF GENERA

The long-spored species have most recently been treated in *Dasyscyphus* S. F. Gray in the sense of R. W. G. Dennis (1949, 1954), but recent changes in the International Code of Botanical Nomenclature which abolish later starting dates (Korf, 1982) necessitate that *Dasyscyphus* be replaced by *Lachnum* for all but *D. cerinus* (Pers.) Fkl. Before the transfers of the species included in this study are made, it is relevant to recount the taxonomy and nomenclature of the scolecosporous Hyaloscyphaceae to clarify the position of the genera in which they have been treated (see fig. 1 for a summary).

Erinella Quélet (Echiridion Fung: 301. 1886) was erected, but a type species was not selected, and it included amongst its original species the type species of *Dasyscyphus* S. F. Gray, of *Lachnum* Retzius and of *Atractobolus* Tode. It was superfluous when published (Article 63 of the International Code of Botanical Nomenclature) and should be rejected in favor of the earliest of its three synonyms, *Lachnum*. Even though *Erinella* Quél. is superfluous, it still needs a type species with which to define the genus in any future discussions. The species *Erinella virginea* Batsch: Fr.) Quél. (≡*Peziza virginea* Batsch: Fr.) is hereby selected as the lectotype of *Erinella* Quél. This fits the original concept of the genus and makes it clearly a taxonomic synonym of *Lachnum* Retz.

In his system of taxonomy based on spore characters, Saccardo (1889) used *Erinella* for scolecosporus Dasyscyphae and Trichopezizae and ascribed it to himself with the reference "Vix Quél." Saccardo included 19 species none of which were included in Quélet's original publication. In his attempt to rectify Quélet's error, Saccardo clearly created a later homonym, and the lectotypification of *Erinella* Sacc. by Clements and Shear (1931) does not change that fact. One can only speculate as to why Saccardo used a name which he knew to be a synonym (Saccardo, 1884). Perhaps he got the idea from a paper by Patouillard and Gaillard (1888) in which they published four new species of

Erinella Quél. from the Upper Orinoco region of Venezuela, all of which had long spores. It was probably not Patouillard and Gaillard's intention to exclude short-spored species of *Erinella*, but they found only long-spored species in this region. Whatever the reason, *Erinella* in any sense is still unavailable for use. Unfortunately, until very recently, it has been used by at least a dozen authors, and there are several tropical species which only have epithets in *Erinella*. Several of these species will receive new combinations in this study.

Dasyscyphella Tranzschel (Hedwigia 38: 11, 1899), was the next genus adopted for the long-spored tropical Hyaloscyphaceae. It was based on the single new species, *D. cassandrae* from Russia and was distinguished from *Lachnella* Fr. and *Dasyscypha* Fkl. by its long spores and from *Erinella* Sacc. by having filiform rather than lanceolate paraphyses. *Dasyscyphella* was used in this sense by several authors including Cash (1948) and von Höhnel (1909). It was not until recently that the type species of *Dasyscyphella* was reexamined by Raitviir (1970) who discovered it to have glandular-tipped hairs like those of *Lachnum niveum* (Hedw.) Karst. Raitviir has transferred *L. niveum* and several related species to *Dasyscyphella* and has used the genus in the same sense as R. W. G. Dennis's *Dasyscypha* section IX, *Niveae* (Dennis 1949).

Erioscypha Kirchstein (Ann. Mycol. 36: 383, 1938) was proposed for species that differed from *Dasyscyphella* in having green-colored ascospores. This character, if it exists at all, seems to have little taxonomic value at the generic level. Uncorrected optics, like those used before the mid-twentieth century cause small hyaline objects to appear green. It was, perhaps, the optics and not the spores that led authors to describe them as "chlorinus" or "viridulus." Korf (1978) reexamined the holotype of *E. kriegeriana* Kirschst. and chose it as the lectotype of the genus. He then placed *Erioscypha* into synonymy with *Dasyscyphus* (sensu Dennis, 1949) and noted that it is related to species in *Belonidium* subgenus *Phaeobelonidium*. Raitviir (1980) further subdivided his segregate genera and used *Lasiobelonium* Ellis & Everh. for the species of *Belonidium* with pigmented and roughened hair-walls and with compact, parallel hyphae in the medulary excipulum. He treated *Erioscypha* as a synonym based on Korf's study, but did not transfer its type species into *Lasiobelonium*. Whether one takes Korf's broad concept of *Dasyscyphus* (=*Lachnum*) or the narrower concept of Raitviir's segregate genera, or even if one wishes to use *Erioscypha* for long-spored species of *Lasiobelonium*, the long-spored, tropical species still do not have a genus of their own.

Erioscyphella Kirschst. (Ann. Mycol. 36: 384, 1938), was proposed at the same time as *Erioscypha* to include species which differed from *Erinella* in having colored spores, and from *Erioscypha* in having lanceolate, rather than filiform paraphyses. Even though, as pointed out by Korf (1978), *Erioscyphella* was based on a superficial feature it was validly published and contained two species, *E. longispora* (Karst.) Kirschst. and *E. bambusina* (Bres.) Kirschst. *Erioscyphella longispora* (≡*Lachnum longisporum* Karst.) is a later synonym of *Peziza abnormis* Mont. and *E. longispora* is here selected as the lectotype of *Erioscyphella* Kirschst. The second species, *Erinella bambusina* Bres., is a later synonym for *Belonidium chusqueae* Pat. which is a good species of *Lachnum*. A revised list of nomenclatural and taxonomic synonyms is presented here:

LACHNUM CHUSQUEAE (Pat.) Haines & Dumont comb. nov.

≡*Belonidium chusqueae* Patouillard, Bull. Soc. Mycol. France 11: 217. 1895.

=*Erinella bambusina* Bresadola, Hedwigia 35: 296. 1896.

≡*Eriocyphella bambusina* (Bres.) Kirschst., Ann. Mycol. 36: 384. 1938.

≡*Dasyscyphus bambusinus* (Bres.) Dennis (as *Dasyscypha bambusina*) Kew Bull. 1954: 301. 1954.

=*Dasyscyphella appressa* Cash, Univ. Iowa Stud. Nat. Hist. 17: 217. 1937.

≡*Erinellina appressa* (Cash) Seaver, N. Amer. Cup-Fungi (Inoperc.), p. 292. 1951.

≡*Dasyscyphus appressus* (Cash) Le Gal (as *Dasycypha appressa*) Discomy. Madagascar, p. 375. 1953.

When the lectotype of *Erioscyphella* is compared with the type of *Lachnum*, *L. virgineum* (Batsch.), it appears at first glance that they are sufficiently distinct to warrant separate genera. The ectal excipulum of *E. longispora* is short-celled textura prismatica, and its spores are 40-60 µm long, while the ectal excipulum of *L. virgineum* is hyaline, long-celled textura prismatica and its spores 8-10 µm long. The difficulty lies in the inability, when confronted by large amounts of tropical and temperate material, to find a break in the continuum of spore sizes and excipulum characteristics between the two type species. Thus, *Erioscyphella* is treated here as a later taxonomic synonym of *Lachnum*. If at a future time the long-spored tropical species can be satisfactorily distinguished from *Lachnum*, *Erioscyphella* is the valid name to be used.

Erinellina Seaver (N. Amer. Cup-Fungi (Inoperc.) p. 290, 1951) was a name proposed for *Erinella* Sacc. not *Erinella* Quel. Seaver tried to correct Saccardo's error, but he was apparently unaware of Kirschstein's *Erioscyphella*

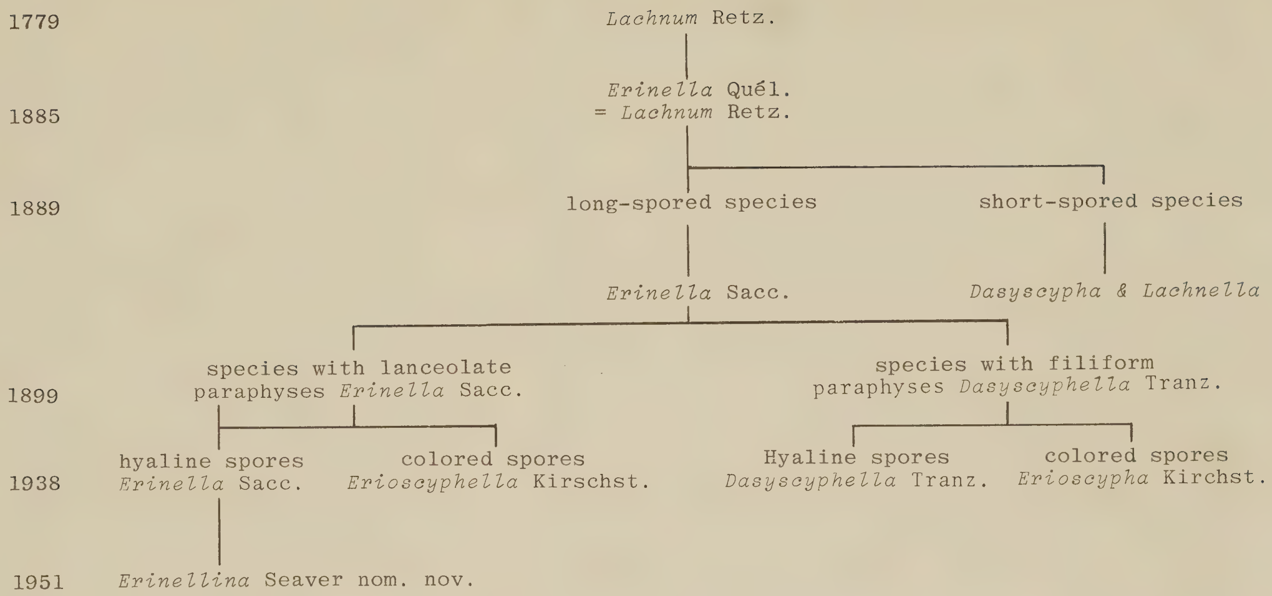
1779
Lachnum Retz.
1885
Erinella Quél.
= *Lachnum* Retz.
1889
long-spored species
short-spored species
Erinella Sacc.
Dasyscypha & *Lachnella*
1899
species with lanceolate
paraphyses *Erinella* Sacc.
species with filiform
paraphyses *Dasyscyphella* Tranz.
1938
hyaline spores
Erinella Sacc.
colored spores
Erioscyphella Kirschst.
Hyaline spores
Dasyscyphella Tranz.
colored spores
Erioscypha Kirchst.
1951
Erinellina Seaver nom. nov.

Fig. 1. Summary of the treatment of the long-spored Hyaloscyphaceae 1779-1951.

TABLE 1. Taxonomic history of *Lachnum abnormis* and *L. brasilense*, 1835-1919.

Author	Author's Work Location	Date	Collector	Type Locality	Species Name	Synonym of
Mont.	Paris	1835	Bertero	Chile	Peziza abnormis	good species
Mont.	Paris	1856	Weddell	Brasil	Cenangium brasiliense	good species
Berk.	Kew	1860	Wright	Japan	Peziza leucophaea	P. abnormis
Berk.	Kew	1868	Wright	Cuba	Peziza illota	C. brasiliense
Berk.	Kew	1868	Wright	Cuba	Peziza raphidofera	C. brasiliense
Berk.	Kew	1875	Thwaites	Ceylon	Peziza simillima	C. brasiliense
Karst.	Helsinki	1889	Wainio	Brasil	Lachnum longisporum	P. abnormis
Bres.	France	1896	Möller	Brasil	Erinella similis	C. brasiliense
Massee	Kew	1898	Gamble	India	Erinella corticola	P. abnormis
Starb.	Stockholm	1899	Malme	Brasil	Erinella avellaneomellea	P. abnormis
Starb.	Stockholm	1899	Malme	Brasil	Erinella isabellina	P. abnormis
P. Henn.	Berlin	1899	Noack	Brasil	Erinella pazschkeana	C. brasiliense
P. Henn.	Berlin	1899	Nyman	Java	Erinella bogoriensis	P. abnormis
Rehm	Berlin	1900	Ule	Brasil	Dasyscyphus gigantosporus	C. brasiliense
Rehm	Berlin	1900	Ule	Brasil	Dasyscyphus schroeterianus	P. abnormis
Pat.	Paris	1903	Duss	Guadeloupe	Erinella cognata	C. brasiliense
Sydow	Berlin	1910	Hildbraed	Africa	Erinella africana	C. brasiliense
Speg.	Argentina	1919	Puiggari	Brasil	Erinella heterotricha	P. abnormis

and merely created a later taxonomic synonym. Seaver's type species, *E. simillima* (Berk. & Br.) Seaver (=*Peziza simillima* Berk. & Br.) is a later synonym for *Cenangium brasiliense* Mont.

HISTORICAL REVIEW OF SPECIES

Just as the taxonomy of this group has been confused at the generic level, it has also been confused at the species level. Large numbers of taxa were described by authors who had never seen tropical fungi in the field, but had received them from collectors who had little taxonomic knowledge of the fungi they were collecting. Often the colors or crystal formations on the specimens were changed by the hot, wet climate or by the methods used to preserve them from decay, such as soaking them in fluids. There was such a flurry of activity in collecting tropical fungi at the turn of the century that mycologists in several European institutions were simultaneously describing the same species from the neotropics and the other tropical regions. Table 1 reviews the taxonomic history of two common tropical species that were described many times. The table also accentuates the fact that none of these authors collected the fungi that they described as new, nor is there any indication that they ever saw those fungi in their natural habitat. Several authors differentiated white species from brown species. In two cases, Berkeley (1868 in table 1) and Starbäck (1899 in table 1), authors described the same species from the same locality twice. In both cases the difference was based on color, and the authors described young material and old material as different species. All of the other "species" were based on collections sent from different locations by different collectors.

MATERIALS AND METHODS

We have observed and collected the lignicolous species of *Lachnum* many times in different tropical regions. It is probable that the amount of discomycete material gathered in the 1970's in connection with the Flora Neotropica project is the largest ever assembled. For other papers based on this material see Haines (1980) & Haines & Dumont (1983). For the sake of economy of space in this paper, only key specimens such as types, exsiccati, and other specimens which have been previously cited or which significantly extend the range of the species, have been included in the lists of specimens examined.* All of this material was dried by warm air within hours of being collected. Material dried in this manner has posed no problem in separating the white-haired and brown-haired species, but there was considerable difficulty in determining the hair color of some specimens collected by others. The difficulty was not correlated with age, but apparently with the way the specimens were dyed or preserved. Some specimens were apparently painted with or immersed in aqueous or alcoholic solutions containing various preservatives.

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* *Complete lists of Flora Neotropica specimens examined are available on request from the authors and will be published in the forthcoming FLORA NEOTROPICA monograph on the Hyaloscyphaceae.*

For the present study, all comparisons of hair color were made on preparations which were revived in 3% KOH and mounted in clear lactophenol for at least a month. Final measurements of spores, hairs, asci and paraphyses were made from material treated this way and from material mounted directly in 3% KOH. The species included here can be distinguished by their spores alone, and through recently collected material the hair-color associated with each spore type was determined. With this information the hair-color of even the most poorly preserved material can be inferred. It became evident that the pigmentation of the hairs after they had been aged in lactophenol was more reliable than observations of the unrevived material or even the information in the original descriptions.

There are discrepancies between the number of septa in spores described in the older literature and those observed by the authors. They are frequently difficult to observe, and some spores form additional septa just prior to germination. The best time to observe septa is when spores are mature but still in the ascus. This occurs before most of the refractive matter (lipid bodies) is formed. Septa are easily observed after the spores have been immersed overnight in 3% KOH with phloxine stain.

Measurements of narrow cells such as spores, paraphyses and asci were made on material left in KOH less than an hour. Cell walls are made elastic and overly wide measurements will result when studying material left in KOH too long.

THE LIGNICOLOUS SPECIES

The use of substrate to delimit the species treated in this work may seem, at first, an artificial criterion, but it has become clear from this study that the nine species described here do form a closely related group. Further, other *Lachnum* species on different substrates apparently are not closely related to this grouping. They are a conspicuous part of the tropical fungus flora and may be as prevalent in the tropics as *L. virgineum* (Batsch) Fr. and its relatives are in temperate regions. These tropical and temperate groups are not known to occur sympatrically, but in their respective regions they are found on similar kinds of woody substrates, and it is probable that their ecological functions are very similar. The species covered in this paper are probably found in all tropical regions of the world, and in some cases a single species is known from distant geographical areas in Asia, Africa and the neotropics.

Relatively little is known about the host specificity of tropical species of *Lachnum* due to the lack of host identifications for the majority of collections. It is known that a single host can support more than one species of *Lachnum*. There are several collections in which a single piece of substrate has two distinct species growing in close proximity.

Some species studied in this work appear to exhibit altitudinal preference. Although collections of commonly collected species such as *L. abnormis* are known from sea level to ca. 3500 m it, together with *L. indicum*, *L. cyphelloides*, and *L. attenuatum*, is commonly found between 1200-1600 meters. *Lachnum sclerotii* and *L. brasilense* are most prevalent under 1500 meters. *Lachnum calosporum*, *L. lagerheimii*, and *L. patena* are most common between 2300-3700 m in the paramos and cloud forests. The species with the shortest spores are found at the lowest elevations and those with the longest spores at the highest. No reason for this phenomenon is proposed.

Several collections of *L. abnormis*, *L. indicum*, *L. sclerotii*, and *L. brasiliense* were seen in which the apothecia were heavily parasitized by a *Nectria* species. This *Nectria* is an undescribed species which will be published in the near future (C. T. Rogerson, personal communication). The parasite infects the apothecium of its host and prevents most ascus formation by developing over the hymenium and margins. There is no apparent preference of this *Nectria* for any one species of *Lachnum*, but it is so far known only from the species treated in this paper.

KEY TO THE TROPICAL, LONG-SPORED, LIGNICOLOUS SPECIES OF *LACHNUM*

1. Spores 25-32 x 2.3-3.0 µm, fusiform, mostly 3-septate, apothecia with buff hairs, hairs often tipped with amber-colored resin masses .... 3. *L. sclerotii*.

1'. Spores longer than 32 µm, not with the above combination of characters .... 2.

2. Spores averaging less than 65 µm long .... 3.

3. Spores fusiform, tapered at both ends, 34-48 x 1.8-2.9 µm, mostly non-septate, hairs white, apothecia often with a blue-black base .... 5. *L. brasiliense*.

3'. Spores clavate or cylindrical with one tapered end, septate .... 4.

4. Spores cylindrical with one tapered end, apothecia stipitate .... 5.

5. Apothecia with at least some brown or buff hairs on the stipe, base of stipe sometimes brown-black, spores 40-60 µm long, commonly 7-septate .... 6.
  6. Spores averaging less than 2 µm wide, hairs light brown ...... 1. *L. abnormis.*
  6'. Spores averaging more than 2 µm wide, hairs medium to dark brown .... 2. *L. indicum.*

5'. Apothecia with grey-green hairs, base of stipe often blue-black, spores 49-65 x 1.2-2.0 µm, mostly 7-septate .... 7. *L. lagerheimii.*

5". Apothecia with white hairs throughout, stipe with white base, spores 32-45 x 1.2-1.7 µm, 0-, 1- or 3-septate, hairs often tipped with clear resin masses .... 6. *L. cyphelloides.*

4'. Spores clavate with one end attenuate, apothecia sessile, spores 39-54 x 3.0-4.2 µm, up to 7-septate, apothecia usually less than 0.7 mm diam. .... 9. *L. attenuatum.*

2'. Spores averaging more than 65 µm long .... 7.
  7. Apothecia with light brown hairs, often tipped with small, amber resin masses, stipe often with brownish black base, spores 80-100 µm, cylindrical with one tapered end, up to 17-septate ... . 4. *L. calosporum.*
  7'. Apothecia with white hairs, often agglutinated by large masses of white matter, base of stipe usually white, spores fusiform with both ends acute, usually 0- or 1-septate, 60-90 µm long .... 8. *L. patena.*

1. LACHNUM ABNORMIS (Mont.) Haines & Dumont, *comb. nov.* Fig. 3a.

≡*Peziza abnormis* Montagne, Ann. Sci. Nat. Bot., sér. 2, 3: 351. 1835.
≡*Trichopeziza abnormis* (Mont.) Sacc., Syll. Fung. 8: 429. 1889.
≡*Dasyscyphus abnormis* (Mont.) Dennis, Kew Bull. 17: 320. 1963.
=*Peziza leucophaea* Berkeley & Curtis, Proc. Amer. Acad. Arts 4: 128. 1860. (non *Peziza leucophaea* (Pers.) Nyl., Not. Sällsk. Fauna Fl. Fenn. Föhr. 10: 31. 1869.)
≡*Erinella leucophaea* (Berk. & Curt.) Sacc., Syll. Fung. 8: 509. 1889.
=*Lachnum longisporum* Karsten, Hedwigia 28: 191. 1889.
≡*Erinella longispora* (Karst.) Sacc., Syll. Fung. 8: 507. 1889.
≡*Erioscyphella longispora* (Karst.) Kirschstein, Ann. Mycol. 36: 384. 1938.
≡*Erinellina longispora* (Karst.) Seaver, N. Amer. Cup-Fungi (Inoperc.) p. 293. 1951.

=*Erinella corticola* Massee, Bull. Misc. Inform. 1898: 115. 1898.

≡*Dasyscyphus corticola* (Massee) Dennis, Kew Bull. 15: 297. 1961.

≡*Erinellina corticola* (Massee) S. C. Teng, Chung-kuo Ti chen-chun (Fungi of China) p. 760. 1964.

=*Erinella avellaneomellea* Starbäck, Bih. Kongl. Svenska Vetensk.-Acad. Handl. 25 Afd. III., No. 1, 6. 1899.

≡*Dasyscyphus avellaneomelleus* (Starb.) Dennis (as *Dasyscypha avellaneomellea*). Kew Bull. 9: 300, 1954.

=*Erinella isabellina* Starbäck, Bih. Kongl. Svenska Vetensk.-Akad. Handl. 25 Afd. III No. 1, 6. 1889.

=*Dasyscyphella schroeteriana* Rehm, Hedwigia 39: 95. 1900.

≡*Dasyscyphus schroeterianus* (Rehm) Dennis (as *Dasyscypha schroeteriana*), Kew Bull. 9: 301. 1954.

=*Erinella heterotricha* Speg., Bol. Acad. Nac. Ci. 23: 511. 1919.

HOLOTYPE - Bertero 1708, May 1830, Juan Fernández Is., Chile. On bark in montane forests. The type packet at Kew contains a single piece of tree bark with 15-20 apothecia. The apothecia are slightly immature and have considerable insect damage to the hymenia, but are otherwise well preserved and rehydrate well in 3% KOH. No additional original material could be located at K or PC.

Apothecia scattered to crowded on bark or wood, globose when young, opening to goblet-shape and finally planate at maturity, 0.5-2.5(-3.5) mm diam, externally covered with pale buff to sienna hairs on the underside and pale buff to white hairs at the margin, when hairs abraiding away then causing the apothecium to appear lighter colored, usually without crystaline or resin-like formations on the tips of the hairs, rarely with red water-soluble formations easily observed with a dissecting microscope, stiptate. Stipe variable, measuring from a narrow peg-like process to a stout cylinder as long as the disc is wide, often with a naked, brown-black base, firmly attached, leaving a short stump when broken off. Disc (hymenium) obscured by the infolded margins of the cup when young, increasingly exposed with maturity, remaining exposed when dried, regularly circular in outline, buff to orange, generally pale luteus, changing little on drying, without color change or conspicuous pigment release in 3% KOH.

Hairs to 150 µm long, mostly 35-70 x 2.2-3.7 µm cylindrical with hemispherical tips, slightly irregular in outline, curved or flexuous, septate, forming cells 8-40 µm long, but varying greatly in a single apothecium, covered externally with minute, tightly-adhering granules up to 0.4 µm diam., walls thin, to 0.6 µm wide, hyaline to ochraceous with transmitted light, always some hairs with pigmented walls and sometimes pigmented contents, often more lightly pigmented or hyaline toward the tips, arising at an angle from the outer-most excipular cells. Marginal hairs often hyaline and longer than the excipular hairs. Sterile tissue composed of several differentiated regions: the innermost or medullary excipulum of very loosely woven, highly branched, hyaline textura intricata composed of thick-walled, long-celled hyphae 1-2 µm diam; the subhymenium, between the hymenium and medullary excipulum, a layer of compact textura composed of thin-walled, short-celled hyphae with indistinctly formed croziers; in the middle the subhymenium grading into the cortex of the stipe and composed of very tightly packed, unbranched, very long-celled hyphae ca 1 µm diam and giving a braided appearance due to the interweaving of many stranded bundles; the ectal excipulum: the innermost layer, layer 25-50 µm thick, of loosely packed parallel hyphae with some interwoven strands, the individual hyphae intermediate in size between those of the medullary excipulum and those of the stipe; the middle layer formed from the tips of the inner layer becoming much thicker and closely septate to form a thin layer of short-celled, textura prismatica composed of cells up to 5 x 10 µm, oriented at 45° angle to the surface of the outer ectal excipulum; the cells becoming smaller, more compact and slightly pigmented, forming a thin layer of cuboid-celled textura prismatica to textura angularis giving rise to hairs. The base of the stipe often covered with hyaline walls to give the base a superficial resemblance to members of the Sclerotineaceae.

Asci (77-)85-96(-105) x (5-)7-9 µm, cylindrical with a tapered base, usually without a recognizable crozier, and a hemispherical apex with a distinct apical pore, J+ with or without KOH pretreatment, staining as a short, hollow cylinder, less than 1.2 µm in each dimension, spores formed in the upper third, eventually filling the entire ascus when mature, 8-spored.

Spores (39-)45-57(-67) x (1.4-)1.7-1.9(2.2) µm, cylindrical flexuous (vermiform), often in a sigmoid configuration, with a hemispherical apex and tapered base narrowing to about 0.8 µm before rounding off, 0-7 septate, commonly 7-septate at maturity just prior to release from the ascus, often with large refractive bodies prior to germination, hyaline, thin-walled.

Paraphyses narrowly lanceolate (2.0-)2.3-2.9(-3.2) µm at their widest point about one fourth back from the tip, with blunt apices, exceeding the asci by 8-12 µm, straight, unbranched, hyaline, thin-walled, without conspicuous contents and non-septate in the upper half.

No anamorphic state observed.

HOSTS - Most commonly found on wood and bark of trees, rarely on woody vines and large herbaceous stems in tropical forests. It occurs on dead stems of all sizes from 2 mm to large tree boles and has occasionally been collected on living trees. Host species are rarely recorded owing to the great difficulty of identifying small detached twigs in tropical forests. The hosts that have been recorded are often distinctive, easily recognized species and may not be representative of the entire host range. Recorded hosts are *Byrsonia spicata*, *Cupressus* sp., *Eucalyptus* sp., *Quercus incana* and *Ulex europaeus*.

RANGE - Apparently widespread throughout tropical regions of the world. It occurs between sea level and 3200 m elev., but is most common between 1700-2600 m elevation in South and Central America. It is known from Argentina, Australia, Bolivia, Brazil, Chile, People's Republic of China, Colombia, Costa Rica, Ecuador, Guadeloupe, India, Jamaica, Japan, Java, Malaya, Mexico, New Guinea, New Zealand, Panama, Peru, Rwanda, Singapore and Venezuela.

PREVIOUSLY PUBLISHED ILLUSTRATIONS - Rehm, Hedwigia 39, pl. 6, fig. 32, 1900 (as *Dasyscypha schroeteriana*); R. W. G. Dennis, Kew Bull. 9: 302, fig. 8 (as *D. avellaneomellea*); 302, fig. 10 (as *D. schroeteriana*); 305, fig. 14d (as *Dasyscyphus brasiliensis*); Dennis, Kew Bull. 15: 297. fig. 6, 1961 (as *Dasyscyphus corticola*); Dennis, Kew Bull. 17: 320, fig. 1, 1963 (as *Dasyscyphus abnormis*).

SPECIMENS EXAMINED: Brazil: Wainio, 1885, Minas, Lafayette, holotype of *Lachnum longisporum* Karsten (H); Malme 107, 12 Dec 1892, Cascata de Hermenegilda Opp. Pelotas, Rio Grande do Sul, type of *Erinella avellaneomellea* Starbäck, 2 packets (S); Malme 180, 24 Jan 1893, Santo Angelo near Cachoeiro do Sul, holotype of *Erinella isabellina* Starbäck (S); Ule 1569, Sep 1889, "Orlegno," holotype (portion of) *Dasyscyphella schroeteriana* Rehm, ex herb. Sydow (S); Noack 269, Jan 1897, Corrego Alegre, Minas Gerais, as *Erinella subcervina* Bresadola, ex herb. Rehm and herb. Sydow (S); Puiggari 19, before 1919, Apiahy, holotype of *Erinella heterotricha* Spegazzini, herbarium number 24434, (LPS); Rick 42, 1928, Porto Novo, Sta. Catharina, on bark (FH); Rick, Oct 1932, Saõ Leopoldo, Rio Grande do Sul, as *Erinella isabellina* (FH). CHILE: See holotype of *L. abnormis*. PEOPLE'S REPUBLIC OF CHINA: Cheo 2023, 6 Jun 1933, Chin Tung (Ling Yuin Hsien), Kwangsi, 1100 m, on dead bark of *Liquidambar* (FH). COLOMBIA: Dumont-CO 335, Haines & Idrobo, 1 Jul 1974, Quebrada Aguas Blancas, road between Sibate & Fusagasuga, Dpto. Dundinamarca, small woody stem (COL, NY, NYS); An additional 21 collections are deposited at NY & COL with some duplicates at NYS. COSTA RICA: Carroll 931, 28 Aug 1964, bench mark 332B, Inter-american Highway, 47.5 km south of San Jose, ca 1850 m (NYS); Carroll 932, 8 Sep 1964, vicinity of Vulcan Barba, ca 1920 m (NYS). ECUADOR: Dumont-EC 373, Carpenter & Buritica, 18 Jul 1975 ca 55 km from Santo Domingo, on new road from Quito to Santo Domingo, Prov. Pinchincha, ca 1800 m, decayed wood (NY); An additional 3 collections are deposited at NY & COL. GUADELOUPE, F. W. I.: Pfister 717, Carpenter, & Sherwood, 3 Jan 1974, Forest Des Bains Jaunes, Guadeloupe National Forest, ca 1050-1155 m, SW slope, very decayed wood (FH). INDIA: Singh, PAN 3810, 29 Jun 1971, Narkanda, Mahasu, Himachal Pradesh, ca 2775 m (previously reported as *Dasyscyphus brasiliensis*, Nova Hedwigia 32: 70, 1980) (PAN, NYS); M. P. Sharma 24, PAN 3928, 24 Jul 1972, Baloon, Dahausie, Himachal Pradesh State, 1525-2150 m (previously reported as *Dasyscyphus brasiliensis*, Nova Hedwigia 32: 70, 1980) (NYS); M. P. Sharma 716, PAN 11716, 18 Apr 1976, near Sainik Rest House, Simla, Himachal Pradesh, ca 2600 m; M. P. Sharma 757, PAN 11757, 28 Sep 1979, Tiffons Top, Kumaon Hills, Nainital, Uttar Pradesh, ca 2130 m (NYS). JAMAICA: CUP-MJ 167, Korf, Dixon, Dumont, Erb, Pfister, Reynolds, Rossman & Samuels, 9 Jan 1981, along Lady's Mile Trail to just South of Woodcutter's Gap, vicinity of New Castle, border of St. Andrew & Portland Parishes, on twig (CUP, NYS); An additional 2 collections deposited CUP. JAPAN: Wright, 14 May 1855, Shudin Hills? Simodah Is., lectotype of *Peziza leucophaea* Berk. & Curt. (K, FH). JAVA: CUP-SA 238; CUP-SA 245, Rifai & Korf, 14 Dec 1961, near Tjibodas River, Tjibodas, Java (substrate for undescribed *Nectria* sp.) (CUP). MEXICO: G. Guzmán 7033; Guzmán 7356, 24 Jun 1969, cerca de Tlilapa, al pie del Río Asserradera, camino Orizaba-Zongolica, Estado Veracruz, 1200 m, Bosque tropical con *Platanus* y cafetal (MEXU, NY); An additional 12 collections deposited NY. NEW ZEALAND: G. J. Samuels, PDD 31945, 20 Aug 1973, farm of Sam Howe, Waipapa West Road, North of Kerikeri, Bay of Islands County, Aukland Prov., on *Ulex eropaeus* (PDD, NYS). PANAMA: Dumont-PA 1685, Carpenter, 2 Jul 1975, oak forest, Cerro Respingo, ca 6 km northwest of town of Cerro Punta, Prov. Chiriquí, ca 2300 m (NY); An additional 10 collections deposited NY. PERU: Dumont-PE 483, Carpenter, Sherwood, & Buriticá, 2 Jul 1976, vicinity km post 469 from Lima, on the Huanuco-Tingo María Road, Dpto. Huánuco, 2250 m (NY); 1 additional collection deposited NY. RWANDA: Rammeloo 4897, 6 Oct 1974, Kinigi, Plantation Rops, *Eucalyptus* bark (GENT); Rammeloo 4445, 31 Aug 1974, Foret de Rugege, 2 km from Garamba on the road to Gisakura, mountain rain forest (GENT). SRI LANKA (Ceylon): Thwaites 11 (original material of *Peziza simillima*. Not the lectotype) (K). U.S.A., PUERTO RICO: Haines PR 178 (=CUP-PR 4065), Korf, Pfister, Rossman, Benson, Sanchez & Skog, 13 Jun 1970, km 23 from Maricao, rte 105, ca 520 m (NYS). VENEZUELA: Dumont-VE 57, Haines, 17 Jun 1971, trail southeast from Humboldt Hotel, Parq. Nac. El Avila, Dto. Fed., rotten wood (NY, NYS); An additional 61 collections deposited in NY with duplicates of some in NYS and VEN.

DISCUSSION.-- This is one of the most common inoperculate discomycetes in the tropics. Macroscopically it is easily distinguished from *L. brasiliense*, *L. cyphelloides* and *L. lagerheimii* by producing brown hairs on the underside of the cup. It can often be distinguished from the very similar *L. sclerotii* with a hand lens by the lack of amber-colored resin deposits on the tips of its hairs. It is most common at elevations near 2500 m, whereas *L. sclerotii* is more common near 600 m elevation.

There is considerable color variation among collections of this species. The hairs at the margin of the cup may range from pure white to ochreous (Rayner, 1970), but the stipe and underside of the cup always have some buff to sienna hairs. This color changes little with drying, but becomes lighter in older specimens as the brown hairs are abraded, exposing the lighter-colored excipulum. The base of the stipe in some apothecia is devoid of hairs and is brown-black at the base, but this is not a consistent feature within the species. The most stable character is spore shape. The cylindrical, 3-7 septate, flexuous spores which are tapered at the lower end are found only in this species and the closely related *L. indicum*. This character has not been found in any of the white-haired specimens examined for this study. Paraphysis shape varies some but is always recognizable as "narrowly lanceolate." Some of the variations described from the types of *L. abnormis* synonyms are possibly attributable to different methods of preservation. When the apothecia are rehydrated in 3% KOH and mounted in lactophenol for a week or more, the variation is minimal, and all within the expected range of variation of a single species.

Examination of original materials of *Peziza leucophaea* Berk. & Curt. proved that here were the two different species, and lectotypification is necessary to define the species. The Kew portion from the Berkeley Herbarium has spores much longer than those in the original description. The description states that they are "1/5000 in. long" (this is presumably a printer's error for 1/500 in which would be 48 µm). Those of the specimen exceed 80 µm and the specimen is the same as *Erinella calospora* Pat., which was described later. Two specimens in the Farlow Herbarium are very similar to one another and may be from the same gathering. Their spores are 40-50 µm long and fit the description in all respects. One of these specimens is from the Ringgold and Rogers, North Pacific Exploring Expedition collection. This packet contains ample substrate, but only a few, poorly preserved apothecia. The other specimen is from the Curtis Herbarium. It has about 25 apothecia in good condition and is accompanied by a small, accurate drawing of the spores and the measurement 1/500". This specimen is hereby chosen as lectotype of *Peziza leucophaea* Berk. & Curt. (non- *Peziza leucophaea* (Pers.: Fr.) Nyl.). Although the specimens sent to Berkeley by Curtis are usually the types of their joint species, in this case it appears that the information sent by Curtis from the specimen in his own herbarium was the basis of the original description.

Erinella bogoriensis P. Henn & Nym. Monsunia 1: 33, 1899, was described from the bark of a tree in Java with spores which the original authors describe as "filiformibus utrinque rotundatis, pluriguttulatis, hyalins 50-55 x 2 µm" and sounds very much like *L. abnormis*, but the type specimen could not be located for study.

2. LACHNUM INDICUM (Cash) Haines & Dumont comb. nov. Fig. 3b.

=*Dasyscyphella indica* Cash, Mycologia 40: 724. 1948.
=*Dasyscyphus indicus* (Cash) Ahmad (as *Dasyscypha indica*), Biol. Soc. Pakistan, Monogr. 1: 37. 1956.

HOLOTYPE - Ahmad 434, 20 Jul 1940, Mussoorie, Uttar Pradesh State (BPI).

Apothecia on thick bark of deciduous tree boles, nearly globose when young, opening to planate at maturity, 1.5-3.0 (-4.0) mm diam, light buff, externally covered with sienna to umber hairs, the individual hairs becoming abraided away to expose the exterior of the cup and remaining pigmented at the margin of the cup. Stipe thick, sometimes darkened exteriorly at the base, usually concealed by the expanded disc at maturity. Disc (hymenium) exposed at maturity even when dry, ochreous to orange-sienna when dry.

Hairs to 150 µm, mostly 35-70 x 2.8-3.8 µm, cylindrical with hemispherical tips, thin to thick walled, walls to 1.0 µm thick, straw to sienna with transmitted light, color in the contents and walls. Ectal excipulum similar to *L. abnormis*. Asci (90-)99-113(-125) x (7-)8-9(-11) µm, cylindrical with a tapered base and hemispherical apex, with distinct apical pore J+, staining as a hollow, tapered cylinder. Spores (35-)40-55(-70) x (-1.8)2.1-2.5(-3.0) µm, cylindrical, flexuous, often C-shaped, with hemispherical apex and slightly tapered basal portion, 0-, 1-, 3-, 5- or 7-septate while still in the ascus. Paraphyses straight, narrowly lanceolate (2.2-)2.5-3.2(-3.7) µm at their widest point with blunt apices.

HOSTS - On thick rough bark of dead hardwood trees. Known from *Quercus incana* Roxb. and unidentified trees.

RANGE - Known from Africa, People's Republic of China, and India, mostly from elevations near 2100 m.

SPECIMENS EXAMINED - PEOPLE'S REPUBLIC OF CHINA: S. Y. Cheo 1868, 13 Apr 1933, Ne Kang (Ling Yuin Hsein), Kwangsi Prov., 1100 m (FH). CONGO (formerly Belgian Congo): D. H. Linder 2154, 16 Feb 1927, Mt. Ninagong, ca 2700 m (FH); Linder 2183, 17 Feb 1927, between Burunga & Lulenga (FH). INDIA: Ahmad 434, 20 Jul 1940, Mussoorie, Uttar Pradesh State, ca 2150 m, "on mossy bark of trees" (BPI); M. P. Sharma 2 (PAN 3907), 19 Jul 1972, Panjpulla, Dalhausie, Himachal Pradesh State, ca 2000 m, on bark of *Quercus incana* (PAN, NYS); M. P. Sharma 651 (PAN 11651), 3 Jun 1977, Glen, Simla, Himachal Pradesh State, ca 2100 m, on thick bark of hardwood tree (PAN, NYS); M. P. Sharma 751 (PAN 11751), 27 Sep 1979, China Peak, Nainital, Uttar Pradesh State, ca 2280 m on thick bark of *Quercus incana* Roxb. (PAN, NYS).

DISCUSSION.-- *Lachnum indicum* differs from *L. abnormis* in having slightly wider spores, longer asci, larger apothecia and more darkly pigmented disc and hairs. In all other morphological features *L. indicum* is very similar to *L. abnormis* and may occur in the same geographic regions. Usually differences as slight as these would be considered to be within the variation of a single species, but in this case most of the known specimens are from the same geographic region and elevation are all on a similar substrate: the thick, rough bark of *Quercus incana* and possibly of other trees. When all of these factors are taken into account *L. indicum* is easily distinguished from *L. abnormis*.

The original description compares *Lachnum indicum* with *Erinella corticola* Massee, from which it differs "in flexuous instead of fusoid paraphyses." However, we have observed the paraphyses to be narrowly lanceolate and not flexuous in both species. The spores of the type of *Dasyscyphella indica* are somewhat flexuous, but are even more so in *E. corticola*.

3. LACHNUM SCLEROTII (A. L. Smith) Haines & Dumont, comb. nov. Figs. 2, 3c.

≡*Belonidium sclerotii* A. L. Smith, J. Linn. Soc., Bot. 35: 14. 1901.
=*Erinella subcorticalis* Patouillard in Duss, Champ. Guadeloupe 67. 1903.
≡*Erioscypha subcorticalis* (Pat. in Duss) Kirschstein, Ann. Mycol. 36: 384. 1938.
≡*Dasyscyphella subcorticalis* (Pat. in Duss) Cash, Mycologia 35: 601. 1943.
≡*Dasyscyphus subcorticalis* (Pat. in Duss) Dennis (as *Dasyscypha subcorticalis*), Kew Bull. 9: 299. 1954.
=*Erinella subcervina* Bres. in Rick, Ann. Mycol. 4: 390. 1906.

HOLOTYPE - W. R. Elliott 1367, 31 Jan 1896, St. Aroment, Dominica, British West Indies, on decorticated branch (K). A very tiny portion of this specimen containing a single whole apothecium and a few fragments remain in the type packet.

Apothecia solitary, scattered or crowded on bark or wood of woody twigs and vines, rarely on herbaceous stems, nearly globose when young, opening to goblet-shape, and finally shallow cup-shaped with a raised, even, circular margin at maturity, 0.5-2.0(-3.0) mm in diam, pale buff; externally completely covered with buff to ochreous hairs except at the margin and there the hairs occasionally lighter or white, hairs becoming abraided and leaving the excipulum exposed, the tips of the hairs usually bearing a lump of amber-colored, resinous matter appearing like minute sugar crystals under a 60 X microscope, slowly dissolving in 3% KOH without conspicuous pigment release or color change, stipitate to subsessile. Stipe funnel-shaped, to 1 mm high and 0.5 mm diam, usually visible in unexpanded apothecia,

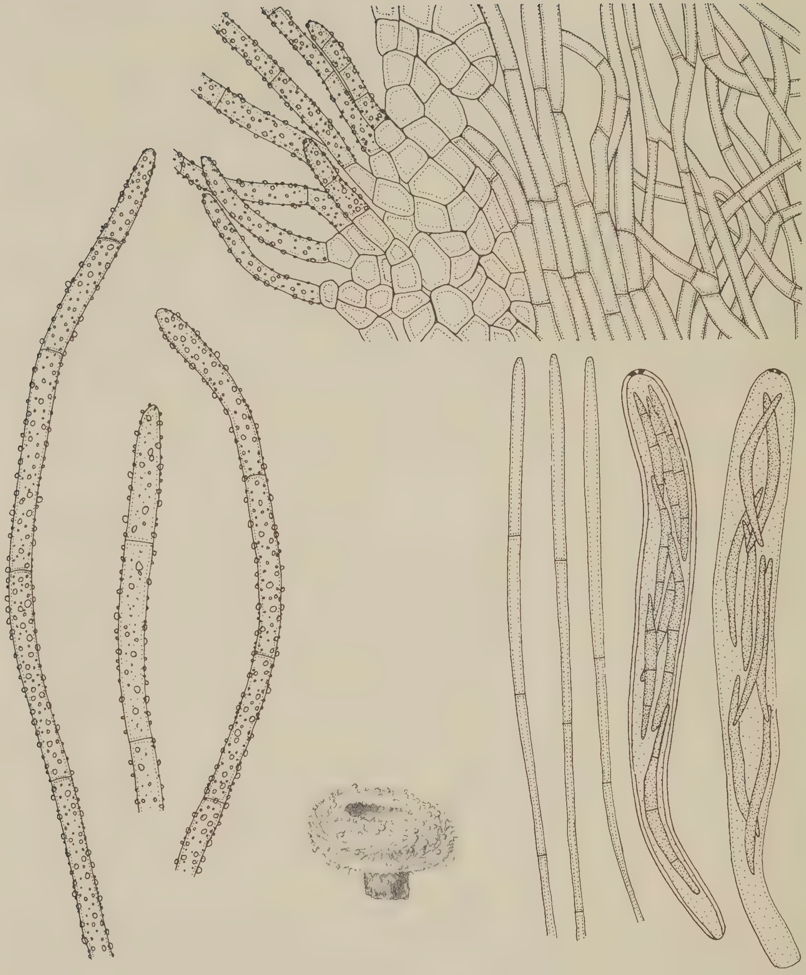

Fig. 2. *Lachnum sclerotii*, a. hairs, b. section through excipulum, c. paraphyses, d. asci, e. apothecium. a., c., d. from type specimen, b. from Dumont VE-310, e. from Dumont CO-2287. a-d. 1000X, e. ca. 50X.

but covered by the upper portion of the cup when expanded, base of stipe very dark brown and devoid of hairs in some apothecia. Disc (hymenium) covered by the infolded margins of the cup when young and increasingly exposed with maturity, remaining exposed even when dry in mature specimens, light buff to luteus, lightening slightly with maturity.

Hairs to 150 µm, mostly 35-70 x 2.5-3.8 µm, cylindrical with hemispherical tips with resinous-appearing matter soon dissolving in aqueous solution, thin-walled, septate, roughened externally with tightly adhering granules to 0.4 µm (coarser than those of *Lachnum virgineum* but finer than those of *Dasyscyphus cerinus*), hyaline to buff with transmitted light, color in the cell contents and cell wall, not removed by extended immersion in KOH or lactophenol solutions. Ectal excipulum very similar to that described for *Lachnum abnormis*. Asci (75-)82-90(-100) x (6.0-)7.0-8.0(-9.4) µm, cylindrical with a tapered base, usually without conspicuous croziers, and hemispherical apex with a distinct apical pore, J+ with or without KOH pretreatment, staining as a hollow cylinder, less than 1.5 µm in each dimension; lower third devoid of spores, collapsing and breaking down soon after spore discharge, 8-spored. Spores (20-)25-32(-43) x (2.0-)2.3-3.0 (-3.2) µm, fusiform, straight or slightly curved, not flexuous, tapered at each end, bipolar or nearly so, becoming 3-septate while still in the ascus, filled with numerous refractive bodies, hyaline, thin-walled. Paraphyses narrowly lanceolate with blunt apices (2.0-)2.3-2.9(-3.2) µm at their widest point (ca 1/3 back from the tips), exceeding the asci by up to 12 µm, straight, unbranched, hyaline, thin-walled and non-septate in the upper half.

HOSTS - Commonly found on wood or bark of hardwood twigs, stems or trunks, occasionally on vines and rarely on herbaceous stems. The host species have very rarely been identified. It has been recorded on *Symplocos martinicensis, Richeria grandis, Xanthoxylon fagara.*

RANGE - Apparently widespread throughout tropical regions, probably in the same regions as *L. abnormis*, but at lower elevations. It is most common below 1500 m. It is known from Brazil, Colombia, Cuba, Dominica, Ecuador, Florida, Guadeloupe, India, Jamaica, Martinique, Panama, Papua New Guinea, Peru, Puerto Rico and Venezuela.

PREVIOUSLY PUBLISHED ILLUSTRATIONS - Dennis, Kew Bull. 9: 300. 1954, fig. 7. left and right figs. only; Cash, Mycologia 35: 598. 1943, fig. 1. Otani, The Botanical Expedition to Papua New Guinea, The National Science Museum, Tokyo. 1975, p. 29. fig. 14 e-i.

SPECIMENS EXAMINED - BRAZIL: Rick, 1904, Saõ Leopoldo (as Fungi Austro-Americani 51, isotype of *Erinella subcervina)* (FH); Rick 187, 1928, Parecy Novo, Rio Grande do Sul (FH); Rick, 1928, Porto Novo, Sta. Catharina (FH); Skvortzov, SP71405, 21 Aug 1964, Parque do Estado, Saõ Paulo, Estado de

Saõ Paulo (NY). COLOMBIA: Dumont CO-546, Haines, Velásquez & Fonnegra, 5 Jul 1974, Buenos Aires, Providencia, Anorí, Rio Anorí, Dpto. Antioquia (COL, NY, NYS): an additional 26 collections deposited COL, NY, & NYS. CUBA: Earle & Murrill 494, 19-20 Mar 1905, Alto Cedro, Santiago de Cuba Prov., on wood in low, dense, virgin forest (NY); W. L. White 342, 20-21 Jun 1941, coffee plantation, San Blas, in foothills of Trinidad Mts., ca 180 m (FH). DOMINICA: (See holotype). ECUADOR: Dumont-EC 413, Dumont, Carpenter & Buriticá, 18 Jul 1975, ca 55 km from Santo Domingo, on the new road from Quito to Santo Domingo, Prov. Pinchincha, ca 1800 m, on wood (NY); an additional 2 collections deposited at NY. GUADELOUPE: Duss 509, 1902, Bois inferrieurs des Bains-Jaunes (lectotype of *Erinella subcorticalis*, herb. Patouillard Sheet 5352, FH); Duss 538, Matouba (original material of *Erinella subcorticallis*) (FH); Duss 1907, Oct 1900, Camp Jacob, on *Symplocos martinicensis* (FH); Duss 1908, Oct 1900, Morne Gommier (FH). HAITI: Buck 9452, 21 Nov 1982, 8 km N of Seguin, on road to Kenscoff, Massif de la Selle, Dept. de Sudest, dwarf cloud forest, 1900 m (NY). INDIA: R. Sharma, PAN 24066, 14 Sep 1981, 12 km from Jamiri towards Buragaon, Arunachal Pradesh, ca 1200 m (PAN, NYS). JAMAICA: Mycoflora of Jamaica 11, Korf, Dixon, Dumont, Erb, Pfister, Reynolds, Rossman & Samuels, 8 Jan 1971, Chesterville Youth Development Camp, above Newcastle, St. Andrew Parish (CUP); 10 additional collections deposited CUP. JAVA: CUP-SA 123, Rifai, Nasution & Korf, 10 Dec 1961, Jungle near Tjibodas, on rotted wood, host for *Nectria* sp. parasite (CUP); CUP-SA 236b, Rifai & Korf, 14 Dec 1961, near Tjibodas River, Tjibodas, host for *Nectria* sp. parasite (CUP). MARTINIQUE: Duss 782, Aug 1903, Camp Colson (herb. Patouillard, sheet 5352, FH). MEXICO: W. A. & E. L. Murrill 892, 5 Jan 1910, Motzorongo, near Cordoba, moist, virgin forest on mountainside (NY). PANAMA: Dumont - PA 157, Carpenter & Mori, 13 Jun 1975, base of Cerro Pilon, 5 km northeast of El Valle, Prov. Cocle, ca 670 m (NY); an additional 8 collections deposited at NY. PERU: Dumont - PE 151, Carpenter, Sherwood & Buriticá, 28 Jun 1976, ca 1/2 hr. drive from Satipo toward Calabaza, on the Satipo-Concepcíon Road, Dpto. Junín, ca 800 m (NY); an additional 5 collections deposited at NY. USA., PUERTO RICO: Haines - PR 102, Korf, Pfister, Rossman, Benson, Sanchez & Skog, 9 Jun 1970, south of El Verde, 17.7 km post, rte 186, near local rte 911, ca 550 m (NYS); Pfister 1308, 7 Apr 1974, El Verde Station (FH); Florida: Thaxter, no date, Coconut Grove (FH); an additional 3 collections deposited NYS. VENEZUELA: Dumont - VE 310, Haines, Morillo & Moreno, 21 Jun 1971, Macarao, Dto. Fed. (NY, NYS); an additional 79 collections deposited NY with some duplicates at NYS and VEN.

DISCUSSION.-- *Lachnum sclerotii* is a very common species closely related to *L. abnormis*. They occur in many of the same areas of the tropics, but *L. sclerotii* is dominant at lower elevations and *L. abnormis* at higher elevations. The two species are so similar macroscopically that it would be difficult to imagine early tropical collectors distinguishing them in the field. With a dissecting microscope, the two can be separated with some success by the presence of hyaline to amber-colored lumps on the hairs of *L. sclerotii*. These lumps are reddish or absent in *L. abnormis*. Anatomically, *L. sclerotii* is easily distinguished by its shorter, fusiform, 3-septate spores.

The original publication of *Erinella subcorticalis* Pat. cites two specimens with no designation of a holotype. In addition, there are at least two additional specimens in the Patouillard herbarium which were known to Patouillard when he wrote the description, but which he did not list in the original description. These latter specimens were apparently the basis of the hosts named in the description. Duss 509 is chosen as the lectotype of *E. subcorticalis*. This specimen is the basis of a fine pencil drawing now fixed to the type sheet at FH which has the same dimensions as those in the original description. It now is composed of about 30 apothecia in a good state of preservation.

The name *Erinella subcervina* Bres. was first used on number 51 of the 3rd fascicle of Rick's Fungi Austro-Americani. It was then published as a new species in Annales Mycologici 4: 309. 1906, with the description as follows: "Die Art ist äusserlich dem *Lachnum avellaneo-melleum* Starb. ähnlich aber durch 3-septierte Sporen verschieden." It is sufficient to distinguish this species from any other known to the authors, and it is treated here as validly published. It is not known how many sets containing this number were issued and no lectotype is proposed at this time.

4. LACHNUM CALOSPORUM (Pat. & Gaill.) Haines & Dumont comb. nov. Fig. 3d.

=*Erinella calospora* Patouillard & Gaillard, Bull. Soc. Mycol. France 4: 101. 1889.
≡*Erioscypha calospora* (Pat. & Gaill.) Kirshstein, Ann. Mycol. 36: 385. 1938.
≡*Erinellina calospora* (Pat. & Gaill.) Seaver, N. Amer. Cup-fungi (Inoper.) p. 291. 1951.
≡*Dasyscyphus calosporus* (Pat. & Gaill.) Dennis (as *Dasyscypha calospora*), Kew Bull. 9: 302. 1954.

HOLOTYPE - Gaillard 248, 26 Aug 1887, between Maipures and San Fernando, Upper Orinoco River region between Colombia and Venezuela, on bark of living tree, (Patouillard Herbarium, sheet 5340, FH).

Apothecia scattered on bark of living or non-living, but sound trees, nearly globose when first developing, opening to goblet shaped, funnel-shaped and finally becoming plate-shaped with a fully exposed disc, to 2 mm diam, externally covered with buff colored hairs sometimes becoming white at the margin and completely absent from the base of the stipe, occasionally with yellow incrustations resembling crystals at the tips of the hairs. Stipe variable in length, not exceeding the diameter of the disc. Disc (hymenium) buff to sienna.

Hairs to 100 x 5.5 µm, mostly 30-55 x 3.5-4.0 µm, hyaline to buff, cylindric to clavate, septate, sparsely roughened with tightly adhering particles up to 1 µm diam, thin to moderately thick-walled, walls up to 1 µm thick, sometimes with brown contents. Asci 100-150 x 10-15 µm, cylindric with a slightly tapered base and hemispherical apex with a distinct apical J+ pore, spores filling the entire ascus when mature, 8-spored. Spores (70-)80-100(-130) x (1.9-)2.1-2.8(-3.2) µm, cylindric-fusoid, with hemispherical apex and tapered base, straight or curved, seldom flexuous, up to 17-septate, often germinating microconidia from each cell. Paraphyses narrowly lanceolate, 2-3 µm at the widest point, with blunt apices exceeding the asci by 10-15 µm, hyaline.

Microconidia (ascospore buds) 1-2 x 1.2-2.5 µm, spherical to elongate-ovate with short, narrow spiculi, hyaline, non-septate.

HOSTS - On bark of living or dead but undecayed hardwood trees. The only recorded host is *Quercus* sp. The remaining specimens are on unidentified bark.

RANGE - The type and several other species are from low elevations but the remainder are from South American páramos 2400-3350 m elevation. Known from Colombia, Cuba, Venezuela, Jamaica and Mexico.

PREVIOUSLY PUBLISHED ILLUSTRATIONS - Dennis, Kew Bull. 9: 303. fig. 11 (as *D. calospora*) 1954. Patouillard & Gaillard, Bull. Soc. Mycol. France 4: pl. XVIII, fig. 7. 1888.

SPECIMENS EXAMINED - COLOMBIA: (see under type above); Dumont-CO 428, Haines & Idrobo, 2 Jul 1974, Parámo de Choachi, road between Bogotá and Choachi, Dpto. Cundinamarca (COL, NY, NYS); an additional 2 collections deposited NY. GUADELOUPE: Pfister 867, Carpenter & Sherwood, 5 Jan 1974, Les Mamelles, Guadeloupe National Forest (FH). JAMAICA: CUP-MJ 473, Korf, Dixon, Dumont, Erb, Pfister, Reynolds, Rossman & Samuels, 14 Jan 1971, along Sulphur River, above Bath Fountain Hotel, St. Thomas Parish, ca 150 m (CUP), Buck 5641, 11 Apr 1981, 7 miles northwest of Muirton on road to Ecclesdown, along trail into John Crow Mts., 18°03'N, 76°20'W, ca 350 m, Portland Parish, very humid secondary forest (NY, NYS). MEXICO: Guzmán 16302B, 6 Aug 1976, Cerro del SE de la poblacion (planta Hidroe electrica). Temascal, Oaxaca, ca 100 m (NY). VENEZUELA: Dumont - VE 1809, Haines, Samuels & Leal, 10 Jul 1971, 2-4 km above Jobito, near San Felipe, Parq. Yurubi, Edo. Yaracuy (NY, NYS); an additional 2 collections deposited NY.

DISCUSSION.-- *Lachnum calosporum* is a relatively rare species which cannot readily be distinguished macroscopically from *L. abnormis*. Some specimens have a yellow substance on the tips of the hairs which may be diagnostic of the species. Microscopically, however, it is easily distinguished from *L. abnormis* by its very long spores which may bud to form microconidia. The spores have a shape reminiscent of *L. abnormis*, but more elongated. *Lachnum calosporum* is readily distinguished from *L. brasiliense* by its cylindrical rather than fusiform spores and brown rather than white hairs.

Lachnum calosporum may be predominantly a very high elevation species, but more collections are necessary to confirm this.

5. LACHNUM BRASILIENSE (Mont.) Haines & Dumont comb. nov. Fig. 4a.

≡*Cenangium brasiliense* Montagne, Ann. Sci. Nat. Bot., sér. 4, 5: 371. 1856.
≡*Dasyscyphus brasiliensis* (Mont.) Le Gal (as *Dasyscypha brasiliensis*), Discom. Madagascar p. 372. 1953.
=*Peziza illota* Berkley & Curtis in Berkeley, J. Linn. Soc., Bot. 10: 368. 1868.
≡*Atractobolus illotus* (Berk. & Curt. in Berkeley) O. Kuntze, Revis. Gen. Pl. 3(3): 446. 1898.
≡*Dasyscyphus illotus* (Berk. & Curt. in Berkeley) Saccardo (as *Dasyscyphs illota*) Syll. Fung. 8: 457. 1889.
=*Peziza raphidofera* Berk. & Curt. in Berkeley, J. Linn. Soc., Bot. 10: 368. 1868.
≡*Erinella raphidofera* (Berk. & Curt. in Berkeley) Sacc. (as *E. rhaphidophora*), Syll. Fung. 8: 509. 1889.
≡*Dasyscyphus raphidoferus* (Berk. & Curt. in Berkeley) Dennis, (as *Dasyscypha rhaphidophora*), Kew Bull. 9: 304. 1954.
=*Peziza simillima* Berkeley & Broome, J. Linn. Soc., Bot. 14: 105. 1873.
≡*Erinella simillima* (Berk. & Br.) Sacc., Syll. Fung. 8: 507. 1889.
=*Erinella similis* Bresadola, Hedwigia 35: 296. 1896.
=*Dasyscyphus gigantosporus* Rehm., (as *Dasyscypha gigantospora*) Hedwigia 39: 219. 1900.
=*Erinella cognata* Pat. in Duss, Champ. Guadeloupe, 67. 1903.
≡*Erioscypha cognata* (Pat. in Duss) Kirschstein, Ann. Mycol. 36: 384. 1938.
=*Erinella africana* H. & P. Sydow, Fungi in Wissenschaftliche, Ergebnisse der Deutschen Zentral-Africa-Expedition 1907-1908 II, p. 100. 1910.

TYPE - Weddell, Goyaz (Goias), Brazil, packet marked Holotype in Montagne Herbarium (PC). Approximately 20 apothecia in fair to poor condition remain.

Apothecia scattered to crowded on bark or wood, globose at first, opening to goblet-shaped, funnel-shaped and finally planate with a fully exposed, regularly circular disc remaining flat when dried, 0.8-2.5 mm diam, buff exterior, completely

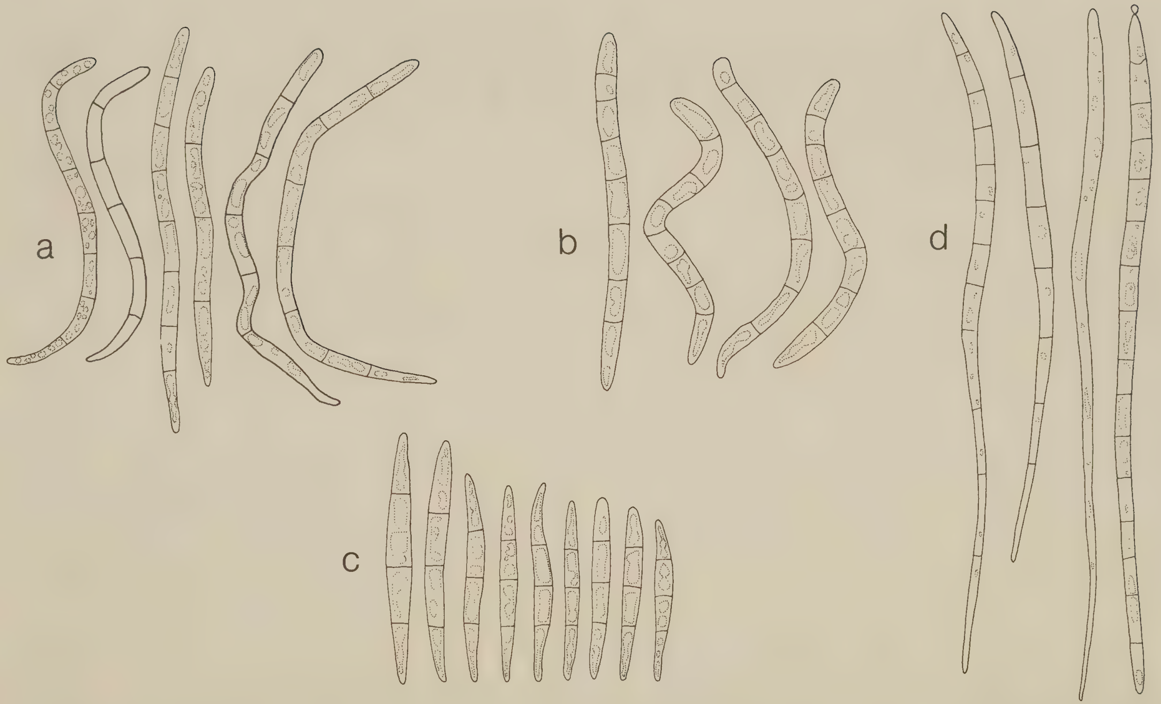

Fig. 3. Ascospores of some tropical, brown-haired *Lachnum* spp. a. *L. abnormis*, b. *L. indicum*, c. *L. sclerotii*, d. *L. calosporum*. All drawn from respective holotype specimens except left 3 spores of d. which are from Dumont CO-428. All drawings 1000X.

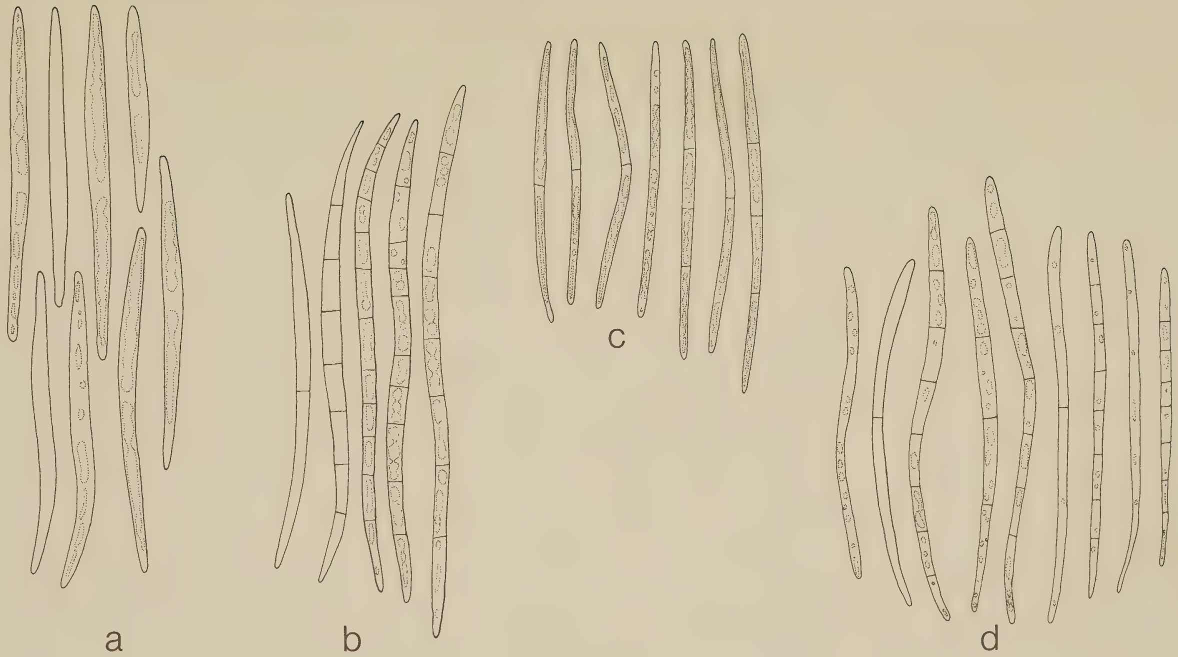

Fig. 4. Ascospores of some tropical, white or green-haired *Lachnum* spp. a. *L. brasiliense* drawn from type specimen of *Peziza raphidofera*, b. *L. patena* drawn from Dumont CO-148, c. *L. cyphelloides* drawn from type of *Dasyscyphella acutipila*, d. *L. lagerheimii* drawn from holotype of *Erinella viridula* Pat. All 1000X.

covered by bright white hairs not capped with resinous or crystaline matter. Stipe as long as the width of disc and 1/5-1/3 its diam, cylindrical to funnel-shaped, concolorous with cup, often with naked, blue-black base, firmly attached to the substrate, leaving a stump embedded in the substrate when detached, context of stipe white, even at the externally blackened base. Disc (hymenium) buff-yellow to orange-yellow, becoming lighter with age.

Hairs 80(-140) x (2.2-)2.6-3.5(=4.0) µm, cylindrical with hemispherical tips, curved or flexuous, septate, forming cells 8-18 µm long, externally roughened with small irregular granules up to 1 µm diam, completely hyaline, walls thin to moderately thickened (to 1 µm), some cells failing to inflate on rehydrating, marginal hairs undifferentiated from excipular hairs.

Sterile tissue composed of clearly differentiated regions. Medullary excipulum composed of loosely woven, highly branched, hyaline textura intricata composed of thin-walled hyphae 1.5-2.5 µm diam. Between the hymenium and medullary excipulum is a layer (the subhymenium) composed of shorter celled hyphae. Below the medullary excipulum the cortex of the stipe composed of densely compact, sparingly branched, hyaline, thin-walled hyphae 0.7-1.2 µm diam with a braided appearance due to the interweaving of many-stranded bundles of hyphae. The ectal excipulum composed of well defined zones; the inner ectal excipulum composed of hyaline, parallel, sparingly-septate, unbranched hyphae 1.5-2.0 µm diam. The outer ectal excipulum formed of hyphae originating from the inner ectal excipulum oriented at a 45° angle to the surface, becoming a wider and more closely septate textura prismatica with thin-walled, hyaline cells 5-10 x 2-4 µm; the outermost layer of cells continuous with the hairs; the entire excipulum becoming very thin toward the base of the stipe. The black pigmentation of the base restricted to the outermost cell layers only. Asci (80-)92-108(-125) x 5-9 µm, cylindric with tapered base without conspicuous croziers at the base and hemispherical apex with a distinct apical J+ pore, spores filling the entire ascus at maturity, 8-spored. Spores (27-)34-48(-59) x (1.9-)2.2-2.9(-3.5) µm, fusiform, rarely flexuous, very nearly bipolar, narrowed to acute apices less than 1 µm, straight or evenly curved, sometimes with one end bent or "kinked", 0 or 1-septate, rarely 3-septate prior to germination, usually filled with refractive matter at each end and a non-refractive space between, hyaline, smooth, thin-walled, germinating from the tips. Paraphyses filiform-clavate to narrowly lanceolate (1.8-)2.0-3.0(-3.4) µm diam at their widest point about 20 µm from the apex, with blunt apices, exceeding the asci in the hymenium by 8-15 µm, straight, unbranched, hyaline, thin-walled, septate in the lower two-thirds only.

HOSTS - On wood and bark of woody dictyledonous and occasionally coniferous trees in tropical regions. Usually on dead but occasionally on living hosts. Host species have very seldom been recorded.

RANGE - Very widespread throughout the tropics. It occurs at all elevations up to 3050 m, but is most common from sea level to 1500 m. It has been collected in Argentina, Bolivia, Brazil, Ceylon, People's Republic of China, Colombia, Costa Rica, Cuba, Ecuador, Guadeloupe, Jamaica, Madagascar, Mexico, Panama, Peru, Rwanda, USA (Puerto Rico), Tanzania and Venezuela.

PREVIOUSLY PUBLISHED ILLUSTRATIONS - LeGal, Discom. Madagascar p. 373, fig. 164, 1953; Dennis, Kew Bull. 9: 304, fig. 13 (as *Dasyscypha rhaphidophora*); 305, fig. 14 (as *Dasyscypha brasiliensis*) 1954; Otani & Tubaki, Mem. Natl. Sci. Mus. Tokyo. 9: 78, fig. 1, s-u, 1976; Cooke, Grevillea 3, pl. 40, fig. 170 (as *Peziza illota*); pl. 41, fig. 198 (as *Peziza simillima*) 1875. Rehm, Hedwigia 39: pl. 9, fig. 20. 1900.

SPECIMENS EXAMINED - BRAZIL: Weddell, Goias, Prior to 1856 (lectotype of *Cenangium brasiliense*) herbarium Montagne (PC); also specimen marked "29 original material", herbarium Montagne (PC); Rick 633, 1928, Porto Novo, Sta. Catharina (FH); Rick, 1930, Sao Leopoldo, Rio Grande do Sul (FH); Pereira, SP 35417, 20 Jun 1956, Jardin Botanico, Parque do Estado, Saõ Paulo, Est. S. Paulo (NY); B. Skvortzev, SP 71384, 9 Sep 1964, Instituto de Botanica, Parque do Estado, Saõ Paulo, Est. S. Paulo (NY). COLOMBIA: Dumont-CO 602, Haines, Velásquez & Fonnegra, 5 Jul 1974, Buenos Aires, Providencia, Anori, Rio Anori, Dpto. Antioquia (COL, NY, NYS); an additional 19 collections deposited COL, NY with some duplicates at NYS. COSTA RICA: Carroll 933, 15 Sep 1964, near Tileran, above El Silencio, ca 750 m (NYS). CUBA: Wright 633, 1855-1857, no location (type of *Peziza illota*) (K, FH, NYS), Wright 364, 1855-1857, (type of *Peziza raphidofera*) (K, FH). ECUADOR: Dumont-EC 695, Carpenter & Buriticá, 19 Jul 1975, ca 19 km from Santo Domingo, on the new road from Santo Domingo to Quito, Prov. Pichincha, ca 800 m (NY). GUADELOUPE, Lesser Antilles: Duss 545, Apr 1902, Bois des Bains-Jaunes (as *Erinella cognata*), herbarium Patouillard, sheet 5341 (FH); Duss 285, Saint-Louis, Marie-Galante Isl. (as *Erinella cognata*), herbarium Patouillard, sheet 5341 (FH). GUATEMALA: Weldon 3343 (as Tulane 7874), 2 Jul 1973, 3 miles north of Carcha in hardwood-pine forest, Dpto. Altoverapaz. JAMAICA: CUP-MJ 162 & 171, Korf et al, 9 Jan 1971, Lady's Mile Trail, south of Woodcutter's Gap, vicinity of Newcastle (CUP); CUP-MJ 333, Korf et al., 11 Jan 1971, near Dick's Pond, west of Hardwar Gap, near Holywell Recreational Area, St. Andrew Parish, 850-900 m (CUP); CUP-MJ 475, Korf et al., 14 Jan 1971, along Sulphur River, above Bath Fountain Hotel, St. Thomas Parish, ca 150 m (CUP); CUP-MJ 618, Korf et al., 18 Jan 1971, trail between Freetown and Wag Water River, near Hardwar Gap, St. Andrews Parish (CUP). MEXICO: Dumont CUP-ME 205, 14 Aug 1967, 1186 km, Highway 190, between Tehuantepec & Comitan, Chiapas (CUP); an additional 5 collections deposited CUP. PANAMA: Dumont-PA 13, Carpenter & Mori, 11 Jun 1975, between Goofy Lake and Cerro Jefe, ca 20.5 km north of Pan American Highway, Prov. Panama, ca 600 m (NY); an additional 5 collections deposited NY. PERU: Dumont-PE 119, Carpenter, Sherwood

Buritica, Guzmán & Reynolds, 27 Jun 1976, along La Merced-Satipo Road, vicinity km post 53 from intersection of La Merced-Oxapampa Road, Dpto. Junín, ca 425 m (NY); an additional 2 collections deposited NY. RWANDA: Rammeloo 4445, Aug 1974, Piste Pindura, Mt. Bigugu (GENT). SRI LANKA (CEYLON): Broome, Ceylon 57, collected by Thwaites prior to 1875 (type of *Peziza simillima*) (K). TANZANIA: G. Hildbraed 251, 23 Jun 1907, near Bukoba on the west shore of Lake Victoria (holotype of *Erinella africana*) herbarium Sydow (S). U.S.A., PUERTO RICO: Haines-PR 158 & 156, Haines, Korf, Pfister, Rossman, Benson, Dixon, Sanchez & Skog, 12 Jun 1970, 20.2 km rte 120 from Maricao, ca 500 m (NYS); Pfister 1352, 12 Apr 1974, Maricao (FH). VENEZUELA: Dumont-VE 50, Haines, 17 Jun 1971, trail southeast of Humboldt Hotel, Parq. Nac. El Avila, Dto. Fed. (NY, NYS); an additional 52 collections deposited NY with some duplicates at NYS and VEN.

DISCUSSION.-- This very common tropical species is distinguished by its white (rather than buff) hair, its blue-black (rather than brown-black) stipe, and its fusiform, 35-48 µm long, often 1-septate spores. It is as abundant as *Lachnum abnormis* and found throughout the same range. It may seem at first that slight differences in hair color are not sufficient characters upon which to base species, but it is clear after examining numerous specimens that hair color and spore shape are strongly correlated and can be trusted as identifying characteristics.

We are proposing here to place eight species into synonymy with *Lachnum brasiliense*. In order to stabilize the nomenclature and taxonomy of this complex, it is necessary to typify some of the names. *Cenangium brasilense* was described by Montagne from material from the state of Goias in Brazil, but no holotype was designated, nor any specific specimens cited. We have located two specimens deposited at PC bearing this name in the Montagne herbarium, and which would serve as logical candidates for a type specimen. The specimens bear virtually no collection data and one is marked "TYPE" and the second is distinguished by the words "29, original material." We hereby designate the specimen marked "Type" as the lectotype specimen for *Cenangium brasiliense* as it contains about 20 mature apothecia and is a larger collection than the "29 original materia specimen. Both specimens represent the same species and appear to have been treated with a preservative which now makes them difficult to rehydrate. The apothecia are in sufficiently good condition to make a positive identification. From a study of the literature and from the lack of annotating material, it appears that this material of *L. brasiliense* has not been reexamined since the original description.

Peziza illota Berkeley & Curtis was described from a single Wright collection from Cuba, No. 633. We have located 4 apparent portions of that collection: 1 at FH, 1 at NYS and two at K. The Kew specimen in the Berkeley herbarium is presumably the portion on which the species was described, and we designate herewith as the lectotype specimen of *Peziza illota*.

The material is well preserved, but difficult to rehydrate.

Dennis (1954) treated *Dasyscyphus rhaphidophorus* as a species distinct from *Dasyscyphus brasiliensis*, but indicated that they could represent the same species. The species was first described by Berkeley and Curtis in 1868 as "*Peziza raphidofera*" an apparent misspelling of "*rhaphidophora*" which has been subsequently utilized by later authors. "*Peziza raphidofera*" was based on a single collection from Cuba, Wright 364. We have located two portions of this collection, one deposited in the Curtis herbarium at FH and one deposited at Kew and presumably the one upon which Berkeley prepared his description. Although the two do represent the same species, it is necessary to designate a lectotype and we hereby designate the Kew portion as the lectotype specimen of "*P. raphidofera*." In the original description, Berkeley cites "Hab. Venezuela", although the species was clearly described from a Wright Cuban collection. We are uncertain of the significance of this and only suggest that it is possible that Berkeley also knew this species from Venezuela, as well as from Cuba.

In this same paper Berkeley also described *Peziza illota*, briefly discussed above. Dennis (1954) recognized *P. illota* and *P. raphidofera* as distinct species as did Berkeley. We disagree with Dennis' decision and conclude that the two represent the same species. We have compared the types of these two and find that there is a difference in the gross morphological appearance, but that they are indistinguishable microscopically. It appears that *P. illota* was probably based on a specimen that was older and not as well preserved as the type of *P. raphidofera*. It is our opinion that the three, *P. illota*, *P. raphidofera* and *Cenangium brasilense* represent the same species, and we adopt the name *brasiliense* since it has priority.

Peziza simillima was described by Berkeley and Broom, who cited two specimens (57 and 11 from Ceylon) in the original description. Neither specimen has been designated as the type; and, in fact, the collections represent different species. It is our opinion that no. 57 better fits the original description than no. 11, and we thus designate herewith no. 57 as the lectotype specimen for *Peziza simillima*. We have compared the lectotype of *P. simillima* with the type of *Canangium brasiliense* and conclude that they represent the same species, and we adopt the name *C. brasiliense* as it has priority. The second specimen, no. 11, is *Lachnum abnormis*.

Erinella cognata is also based on two syntypes, Duss 545 and 285, which are now preserved in the Patouillard herbarium at FH. They are conspecific but 545 is a much larger collection in better condition and is hereby chosen as the lectotype of *E. cognata*.

6. LACHNUM CYPHELLOIDES (Pat.) Haines & Dumont, comb. nov. Fig. 4c.

≡*Erinella cyphelloides* Patouillard, Bull. Soc. Mycol. France 15: 205. 1899 [Non *Dasyscyphus cyphelioides* (Rehm) Sacc. (as *Dasyscypha cyphelioides*) Syll. Fung. 8: 464. 1889].

=*Dasyscyphella acutipila* Cash, Stud. Nat. Hist. Iowa Univ. 17: 216. 1937 [Non *Dasyscyphus acutipilus* (Karst.) Sacc. (as *Dasyscypha acutipila*), Syll. Fung. 8: 447. 1889].

≡*Dasyscyphus martinii* Dennis (as *Dasyscypha martini*), Kew Bull. 9: 303. 1954.

HOLOTYPE - Duss 1240, Bois do morne Graine-Verte, Guadeloupe, on *Byrsonia spicata*, Sheet 5342, Patouillard Herbarium (FH) now in poor condition.

Apothecia scattered to crowded on twigs and stems, globose at first, opening to goblet and then funnel-shaped with a fully exposed regularly circular disc remaining exposed when dried, to 2 mm diam, externally buff, completely covered by bright white hairs capped with white to pale yellow resinous or crystaline matter. Stipe occasionally longer than disc width, 1/6 - 1/4 the diam of the disc, always white and covered with hairs. Disc pale to medium yellow.

Hairs to 80 x 2.5-3.7 µm, cylindrical with hemispherical tips or constricted, ending in a smooth spherical knob, tapered slightly at the base, curved or flexuous, externally roughened, with small irregular granules to 0.7 µm diam, thin-walled, hyaline throughout, septate, forming cells 1-20 µm long; marginal hairs undifferentiated from excipular hairs. Ectal excipulum similar to that of *L. brasiliense*. Asci (58-)64-72(-80) x 4.5-6.0 µm, cylindrical with a tapered base without conspicuous croziers, apex hemispherical, 8-spored, with a distinct pore visible in phase contrast without stain, pore wall J+. Spores (27-)32-45(-52) x 1.2-1.7 µm, very narrowly fusiform, straight, curved or sinuous, bipolar, 0- or 1- septate, filled with spherical refractile bodies (lipid?), appearing like a string of graduated pearls from one end of the spore to the other, (this string usually interrupted in the center by the median septum and once in each cell presumably by the nuclei), hyaline, smooth, thin-walled. Paraphyses filiform to narrowly but distinctly lanceolate, 1.1-2.5 µm at their widest point about 1/4 back from the apex, with pointed apices exceeding the asci in the hymenium by 5-12 µm, straight, unbranched, hyaline, thin-walled and non-septate in the upper half.

HOSTS - On twigs and stems of dicotyledonous trees. Most collections are from unidentified hosts but the species has been recorded from *Byrsonia spicata*.

RANGE - Known as yet only from central America, northern South America and the Lesser Antilles at elevations from 1200-2300 m. Known from Colombia, Guadeloupe, Mexico, Panama, and Venezuela.

PREVIOUSLY PUBLISHED ILLUSTRATIONS - Dennis, Kew Bull. 9: 303, fig. 12 (as *Dasyscypha martini*) 1954; 300, fig. 7 center (as *E. cyphelloides*) 1954. Cash, Stud. Nat. Hist. Iowa Univ. 17: 223, pl. 14, fig. 1 (as *Dasyscyphella acutipila*) 1937.

SPECIMENS EXAMINED - COLOMBIA: Dumont-CO 183, Haines, Idrobo, & Velásquez, 29 Jun 1974, El Bosque de Las Mercedes, Boyaca, Dpto. Cundinamarca (COL, NY, NYS); an additional 5 collections deposited COL, NY, NYS. GUADELOUPE (Lesser Antilles): Duss 1240 (see under holotype). MEXICO: CUP-ME 134, Dumont, 10 Aug 1967, between 18-19 km, on road from Oaxaca to Valle National, Oaxaca (CUP, NYS). PANAMA: G. W. Martin 2275, 1 Jul 1935, valley of upper Rio Chiriqui Viejo, Prov. Chiriqui, 5200-6000 ft. (type of *Dasyscyphella acutipila*) (BPI); (also Martin 2218 & 2498); Dumont-PA 1724 (NY), 1796 (NY); 1799 (NY).

DISCUSSION.-- *Lachnum cyphelloides* is a relatively rare and poorly known species which may be confused with *L. brasiliense*, but it has a lighter colored disc, usually has lumps of resinous-appearing matter on the tips of the hairs visible through the dissecting microscope and without the blue-black base which is characteristic of *L. brasiliense*. Microscopically, *L. cyphelloides* has long needle-shaped spores often with a median septum and refractile bodies which resemble a string of pearls. The spores are much narrower and its asci are shorter than those of *L. brasiliense*.

The holotype specimen is immature and in poor condition and the coloration of the hair is now masked by resinous matter. Dennis (1954) concluded that it may be immature material of *Dasyscyphus subcorticalis* Pat. which was also originally described by Patouillard from Guadeloupe. After considerable searching, we found in the type several mature flexuous spores measuring 45 x 1.5 µm and the knob-headed hairs typical of this species. These features eliminate the possibility of *D. subcorticalis* and *L. cyphelloides* being conspecific. It also explains why Patouillard annotated a later specimen, Duss 495, Aug 1901 from Martinique, as *L. cyphelloides* when it was really the white-haired species *L. brasiliense*. This might indicate that the type of *E. cyphelloides* was also white-haired when fresh.

7. **LACHNUM LAGERHEIMII** Haines & Dumont, nom. nov. Fig. 4d.

> ≡*Erinella viridula* Patouillard, Bull. Soc. Mycol. France 11: 218. 1895. [non *Lachnum viridulum* Massee & Morgan in Morgan, J. Mycol. 8: 187. 1902. nec. *Erinella viridula* (Schrad.: Fr.) Quél., Enchir, Fung. p. 305. 1886].

HOLOTYPE - Lagerheim, Pululahua, Ecuador, Patouillard Herbarium, sheet 5354, (FH).

Apothecia scattered or gregarious, on wood or bark, goblet shaped to plate shaped, almost flat when mature, fully exposed even when dry, 0.3-1.2(-2.0) mm diam, externally white to buff, covered by white to blue-green hairs without crystaline or resinous particles; discs cream-yellow to light grey, changing little with drying; stipe black shading to blue-green above, funnel-shaped, similar to *L. brasiliense* in section.

Hairs to 80 x 2.5-3.3 µm, cylindrical with hemispherical tips, curved or flexuous, septate with cells 12-18 µm long, roughened externally with small, irregular granules to 0.8 µm diam, walls thin, hyaline or yellow-green with transmitted light, sometimes turning purple-black in 3% KOH, devoid of large crystaline or resinous structures, arising at an angle from the outermost excipular cells. Asci (80-)90-115(-128) x 7-11 µm, cylindrical with a long, tapered base and hemispherical to conical apex with a distinct, J+, pore. Spores (45-)49-59(-70) x 1.2-1.9(2.1) µm, narrow-filiform, slightly tapered at the base, straight or curved, sometimes flexuous, hemispherical at the apex, up to 7-septate, septa sometimes thin and difficult to see, without staining, usually without refractive contents, hyaline, thin-walled. Paraphyses filiform-clavate or narrowly lanceolate, 1.5-2.5(-3.0) µm wide at their widest point, exceeding the asci by 8-15 µm, straight, unbranched, nonseptate in upper half, thin-walled, hyaline, without conspicuous contents.

HOSTS - Commonly found on bark of dead stems 1-4 cm diam, many of which have a very large pith. No host species have been identified for any known collections.

RANGE - Known only from Colombia, Ecuador, Mexico, Panama, Peru & Venezuela. It is apparently restricted to high elevations. All known collections were made between 2300 and 3200 m in oak forest or páramo.

PREVIOUSLY PUBLISHED ILLUSTRATIONS - None.

SPECIMENS EXAMINED - COLOMBIA: Dumont-CO 3617, Buriticá, Molina & Luteyn, 26 Jan 1976, vicinity km posts 75-76 from Pasto, Pasto Mocoa Road, Intendencia. Putumayo, ca 2425 m (COL, NY); an additional 5 collections deposited COL, NY, NYS. ECUADOR: (See type). PANAMA: Dumont-PA 1706 & PA 1758 Carpenter, 2 Jul 1975, oak forest, Cerro Respingo, ca 6 km northwest of Cerro Punta, Prov. Chiriqui, ca 2250 m (NY). PERU: Dumont-PE 1195, Carpenter, Sherwood & Buriticá, 9 Jul 1976, ca 135 km from Huancayo, Satipo-Huancayo Road, Dpto. Junín, ca 3200 m (NY). VENEZUELA: Dumont- VE 2400; VE 2412; VE 2428; VE 2430, Haines & Samuels, 19 Jul 1971, El Pino, 16 km east of Apartaderos, Mérida-Barinas Road, Edo. Mérida (NY, NYS); an additional 8 collections deposited NY, NYS.

DISCUSSION.-- *Lachnum lagerheimii* is a rare and distinctive species which is one of the very few species of the genus with blue-green hairs and the only one with filiform spores. It is closely related to *L. brasiliense* from which it differs in having long, filiform, 7-septate spores instead of fusiform 0- 1-septate spores. *Lachnum brasiliense* often has blue-green hairs on the upper part of its stipe, but they seldom extend to the margin as they do in *L. lagerheimii*. *Lachnum cyphelloides* has similarly shaped spores, but they are shorter and usually with only a single septum. *Lachnum cyphelloides* is usually totally white and has resinous accretions at the tips of its hairs. The blue-green hair color of *L. cyphelloides* is apparently variable or perhaps mutable by storage conditions. The type specimen was described as "cinereo-viridis" by Patouillard in 1895. It is now almost white with only a trace of color on the hairs of the stipe. One collection, Dumont-VE 2404, which was made at the same time and place as VE 2400, VE 2412, VE 2428, and VE 2430 is very lightly colored, but has the same spore characters as the other specimens. Spore characters should always be used to confirm the identity of this species.

Most of the pieces of substrate for the known collections of this species bear a resemblance to one another, and even though unidentified in the field, they may all be the same host species. The characteristic piece of host stem is woody, but has a very large pith which breaks down to leave a hollow center in larger stems.

The epithet "*viridula*" is appropriate and descriptive for this species, but it has been used for several different species in the Hyaloscyphaceae. Patouillard's *Erinella viridula* was a later homonym when published and would still be a later homonym if transferred to *Lachnum*. A new epithet is, therefore, required for this taxon. The name chose here commemorates the first collector, G. de Lagerheim.

8. LACHNUM PATENA (Lév.) Haines & Dumont comb. nov. Fig. 4b.

≡*Peziza patena* Léveillé, Ann. Sci. Nat. Bot., Sér. 4. 20: 290. 1863.
≡*Dasyscyphus patena* (Lév.) Sacc. (as *Dasyscypha patena*), Syll. Fung. 10: 22. 1892.
≡*Atractobolus patena* (Lév.) O. Kuntze, Revis. Gen. Pl. 3(3): 446. 1898.

ISOTYPES - Lindig 888, Jun 7, Canoas, near Bogotá, Colombia, ca 1600 m (FH); Lindig 888, Aug, Tequendama, near Bogotá, Colombia, ca 2500 m (presumably at PC but not located).

Apothecia soliary or scattered on woody substrate, globose when young, opening to goblet or cup-shaped at maturity, 0.8-2.5(-4) mm diam, tough and leathery when fresh, tough and brittle when dry, buff, completely covered by bright white hairs often agglutinated at the tips of opaque white masses ca 50 µm across; stipe thick, funnel-shaped, white throughout, covered with white hairs, with a transluscent center visible in broken specimens. Disc orange-yellow, dished or flat, exposed in fresh and dried condition.

Hairs (25-)60-90(-150) x 3.5-4.7 µm, evenly cylindrical with hemispherical tips and tapered base, curved or flexuous, septate, forming cells 14-28 µm long, externally covered by irregularly-shaped, tightly adhering granules up to 0.7 µm diam, walls thin, hyaline, sometimes agglutinated together in fascicles by white amorphous accretions up to 50 µm diam, insoluable in 3% KOH. Ectal excipulum as in *L. brasiliense* but without darkly pigmented base. Asci 99-128(-145) x 6-11 µm, cylindrical with long tapering base and conical apex with a distinct, J+ pore up to 3 µm wide.

Spores (50-)59-75(-109) x 1.8-2.8 µm, very narrowly fusiform, acute at both ends, with bipolar symmetry, straight, curved (falcate) or sigmoid, 0- to 13-septate, usually 7-septate, often filled with refractive contents, hyaline, thin-walled. Paraphyses clavate or narrowly lanceolate, 2.0-3.2 µm at their widest point, with blunt apices, non-septate in upper half, hyaline, thin-walled, without refractive contents.

HOSTS - Most commonly collected on dead or rarely on living woody stemps 1-5 cm in diam, mostly with a large central pith. Host species usually not recorded, but known from *Verbesina* sp. It is possible that all collections are from woody composites.

RANGE - Known from 2300-3700 m elevation in Colombia, Ecuador, Panama, and Venezuela. These high elevation areas are known as *páramos* or *subpáramos* which are characterized by cool temperatures and very high moisture in the form of mist. A conspicuous component of the flora is woody, tree-like, compositae which are the hosts of this fungus.

PREVIOUSLY PUBLISHED ILLUSTRATIONS - None.

SPECIMENS EXAMINED - COLOMBIA: Dumont-CO 4230, Carpenter & Sherwood, 5 Jun 1976, between km posts 16-17 from Mosquera, on Mosquera-La Mesa Rd., Dpto. Condinamarca, 2800 m (COL, NY); Dumont-CO 148, Haines, Idrobo and Velásquez, 29 Jun 1974, El Bosque de Las Mercedes, Boyacá, on bark of *Verbesina* sp. (COL, NY, NYS). ECUADOR: Brako 4479, 3 Jun 1982, Yanacocha Trail, N side of Mt. Pichincha, Prov. Pichincha, cloud forest, 3700 m (NY). PANAMA: Dumont-PA 1989 and Carpenter, 3 Jul 1975, Bamboo and oak forest, La Cumbre, 3-4 km N of Cerro Punta, Prov. Chiriquí, 2200-2300 m (NY). VENEZUELA: Dumont-VE 2375, Haines & Samuels, 19 Jul 1971, Laguna La Victoria, ca 16 km E of Apartaderos, Parq. Nac. Sierra Nevada, on Mérida-Barinas Rd., Edo. Mérida, on recently killed tree (VEN, NY, NYS); an additional 10 collections deposited NY & NYS, with selected duplicates at VEN.

DISCUSSION.-- This is a cloud forest or *pâramo* species, distinguished from all others by its pure white-haired apothecia and very long fusiform spores. Macroscopically it is distinguished from *L. cyphelloides* by the large white masses of matter on its hairs, and from *L. brasiliense* by its pure white stipe. Microscopically it is distinguished from the brown-haired, equally long-spored *L. calosporum* by its fusoid rather than cylindrical spores.

The original description lists two collections, but only one of these could be located at the time of the study. A request to PC could not produce any original material, but a search of unidentified discomycete collections at FH uncovered an unnamed specimen ex herbarium Lindig with no. 888, the number of the original material and locality information matching one of the two cited in the original publication of *P. patena*. Apparently, #888 is a species number and not a collection number. The FH material is not in good condition, but there is enough remaining to identify the taxon. It was decided not to lectotypify *L. patena* with this material because of its poor condition and because of the possibility of other portions of the material being located at PC or elsewhere.

9. LACHNUM ATTENUATUM Haines & Dumont spec. nov. Fig. 5.

Apothecia 0.7 mm diam, cupuliformia, brevissime stipitata, albopilosa; discus luteoaurantiacus; pili tenues cylindrici granulati, hyalini, interdum brunneo-incrustati; asci 77-79 x 7-12 µm anguste clavati e basi angustato, recti vel curvati, 1-7 sepatati; paraphyses clavato-filiformès.

Typus: Dumont-PE 481, Carpenter, Sherwood & Buriticá, 2 Jul 1976, vicinity km Post 469 from Lima, Huanuco-Tingo María Rd., Dpto. Huanuco, Peru, ca 2150 m, on unidentified hardwood twig (NY).

ETYMOLOGY - Latin=Attenuatum. This refers to the tapered lower end of the ascospore.

Apothecia scattered to crowded on bark of host, appearing as a tuft of white hairs when young, becoming cup-shaped at maturity, to 0.7 mm diam including protruding hairs, often less than 0.5 mm at maturity, ochre, covered by bright-white hairs, sometimes appearing pale ochre with hairs abraiding away, sometimes with brown, resinous accretions on the tips and surfaces of hairs, sessile or very short stipitate, fundibuliform below with buff to ochre, never blackened base and firmly inserted in substrates. Disc (hymenium) 0.2-0.5 mm across, yellow-orange, often breaking into fragments at maturity, covered by hair when young.

Hairs to 120 µm long, generally 50-90 x 2.8-4.2 µm, cylindrical with hemispherical tips, straight or curved, septate, cells 9-25 µm long, hyaline, thin-walled, externally covered with minute, tightly adhering granules up to 0.4 µm diam, appearing longer than broad, often covered at the tip

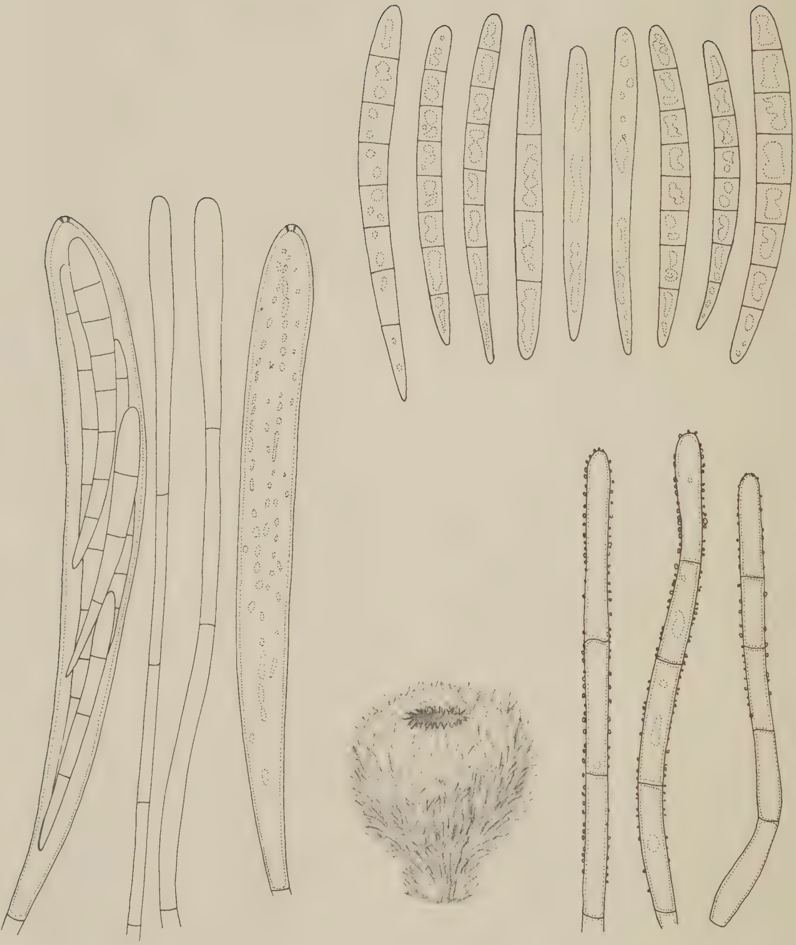

Fig. 5. *Lachnum attenuatum*, from holotype, a. hairs, b. asci, c. paraphyses, d. spores, e. apothecium. a-d. 1000X, e. 50X.

with a dark brown, non water soluable, resinous matter. Asci 79-99 x 7-12 µm, clavate with tapered base, croziers present or absent, apex slightly conical, usually with a large pore ca 1.5 µm broad, with J+ walls, lacking in some specimens, 8-spored with spores clustered in upper half at maturity. Spores 39-54 x 3.0-4.2 µm, narrow-clavate, straight or evenly curved, not flexuous, with blunt apex and tapered base, with widest point about 1/3 back from apex, 1- to 7-septate, most commonly 7-septate at maturity, hyaline, refractive when seen with phase optics, losing refractive quality after several hours in 3% KOH, without large lipid bodies, thin-walled. Paraphyses clavate-filiform, 1.3-2.4 µm diam at widest point near apex, straight, unbranched above the base, 1- 3-septate, hyaline, thin-walled, without conspicuous contents or adhering particles.

HOSTS - All known collections are on unidentified, woody, angiosperms. They are all on small twigs 0.3-1.0 cm diam except the collection from India which is on bark from a considerably larger stem.

RANGE - Known so far from only 3 locations in Peru and one from India; all were between 1500-2150 m elevation.

SPECIMENS EXAMINED - PERU: Dumont-PE 314, Carpenter, Sherwood & Buriticá, 28 Jun 1976, ca 40 km from Calabaza toward Concepcion, on the Satipo-Concepcion Rd., Dpto. Junín ca 2100 m (NY, NYS); Dumont-PE 469, 2 Jul 1976, vicinity km post 469 from Lima, Huanuco-Tingo María Rd., Dpto. Huanuco, ca 2150 m (NY); Dumont PE 481 (Type); PE 484; PE 489 (NY, NYS); Dumont PE 1626, 19 Jul 1976, along the Cuzco-Pilcopata-Paucartamo Rd, ca 135 km from intersection with the Cuzco-Puno Rd., Dpto. Cuzco (NY). INDIA: R. Sharma, PAN 24031, 9 Sep 1981, ca 15 km from Rupa towards Shergaon, Arunachal Pradesh, ca 1500 m (NYS, PAN).

DISCUSSION.-- This species is closely related to others treated in this paper, but is easily distinguished from them by its clavate spores. It has smaller, almost sessile apothecia, with white hairs which sometimes appear pinkish due to a reddish-brown accretion on their tips.

It is perplexing that two of the collections, PE 314 and PE 1626 apparently lack a stainable ascus pore. The collections in question are the same as the type in all other respects including the appearance of the substrate. The Indian collection is identical to the type in every respect except for the size of the stem of its host.

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LITERATURE CITED

Cash, E. K. 1948. Six new Indian discomycetes. *Mycologia* 40: 724-727.

Clements, F. E. & Shear, C. L. 1931. *The genera of fungi.* New York, H. W. Wilscon Co, IV, 496 pp, 58 pl.

Dennis, R. W. G. 1949. A revision of the British Hyaloscyphaceae with notes on related European species. *Mycol. Pap.* 32: 1-97.

___________. 1954. Some inoperculate discomycetes of tropical America. *Kew Bull.* 9: 289-348.

Haines, J. H. 1980. Studies in the Hyaloscyphaceae I: Some species of *Dasyscyphus* on tropical ferns. *Mycotaxon* 11: 189-216.

___________ & Dumont, K. P. 1983. Studies in the Hyaloscyphaceae II: *Proliferodiscus*, a new genus of Arachnopeziziodeae. *Mycologia* 75: 535-543.

Höhnel, F. von. 1909. Fragmente zur Mykologie (VIII. Mitteilung, Nr. 354 bis 406). *Sitzunsber, Kaiserl. Akad. Wiss., Math-Naturwiss. Kl.* Abt. 1, 118: 1157-1246, pl. 1, 2.

Korf, R. P. 1978. Nomenclatural and taxonomic notes on *Lasiobelonium, Erioscypha* and *Erioscyphella. Mycotaxon* 7: 399-406.

___________. 1982. Mycological and lichenological implications of changes in the code of nomenclature enacted in 1981. *Mycotaxon* 14: 476-490.

Patouillard, N. & Gaillard, A. 1888. Champignons du Venequela et principalement de la region du Haut-Orénoque, récoltés en 1887 par M. A. Gaillard. *Bull. Soc. Mycol. France* 4: 92-129.

Raitviir, A. 1970. *Synopsis of the Hyaloscyphaceae. Scripta Mycol.* 1: 1-115.

__________. 1980. The genus *Lasiobelonium. Scripta Mycol.* 9: 99-132.

Rayner, R. W. 1970. *A Mycological Colour Chart.* Chart I: Sheets 1-8; Chart II; Sheets 1-8. Commonwealth Mycological Institute, Kew.

Saccardo, P. A. 1884. Conspectus generum Discomycetum hucusque cognitorum. *Bot. Centralb.* 18: 1-16.

__________. 1889. *Sylloge fungorum, omnium hucusque cognitorum.* 8: i-xvi, 1-1143.

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ASCOSPHAERA SPECIES INCITING CHALKBROOD IN NORTH AMERICA AND A TAXONOMIC KEY[1]

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SUMMARY

Chalkbrood-infected larvae of the honey bee (*Apis mellifera*) and the leafcutting bee (*Megachile rotundata*) were obtained from various locations in the United States, Canada and Central America. The samples were examined for *Ascosphaera* species present, mating type distribution, and strain compatibility. All strains obtained were tested for compatibility with one another and also were mated with authentic cultures of *A. apis*, *A. major* and *A. proliperda*. The three species tested are not interfertile. *Ascosphaera apis* was the only *Ascosphaera* species observed in 260 honey bee mummies and all strains were compatible. In the white honey bee mummies, 44% were + mating type only, 27% were - mating type only, and 29% contained both mating types. All leafcutting bee mummies (13 collections, 221 mummies) were encased in ascocarps of *A. aggregata*, but *A. apis* also was recovered from 23% of the samples. *Ascosphaera apis* only was recovered from one soil cell of the alkali bee (*Nomia melanderi*). The common pathogenic species in North America appear to be *A. apis* in honey bees and *A. aggregata* in leafcutting bees. At present there are no authentic North American records for *A. major* or *A. proliperda*. A dichotomous key to the eight described species in *Bettsia* and *Ascosphaera* is appended as an aid to species identifications.

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[1] Additional keywords: honey bee, insect mycosis, leafcutting bee, *Apis mellifera*, *Megachile centuncularis*, *Megachile rotundata*, *Nomia melanderi*, *Osmia rufa*.

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INTRODUCTION

Chalkbrood is a fungal disease which infects the brood of honey bees and some solitary bees. The disease was first described from Germany in honey bees (*Apis mellifera* L.) (Maassen, 1913). Subsequently it was reported from Switzerland in 1918, Poland in 1921, France in 1929, England in 1932, Scotland in 1934, New Zealand in 1957, and from Japan in 1973 (Hitchcock, 1972; Udagawa & Horie, 1974). Chalkbrood was first observed in North America in Utah in 1965 by Baker and Torchio (1968), who isolated + and - strains of "*A. apis* var. *apis*" (Spiltoir & Olive, 1955) from the nest of a leafcutting bee (*Megachile inermis* Provancher) which contained a "living non-infected prepupa" that later was reared to the adult stage. In 1966, those same investigators identified "*A. apis* var. *major*" from the cell of a soil nesting bee (*Anthophora pacifica* Cresson) where, also, there was a living non-infected prepupa (Baker & Torchio, 1968). In view of the imprecise distinction of those *Ascosphaera* varieties prior to 1972 (Skou, 1972; see also Hitchcock & Christensen, 1972 and Christensen & Gilliam, 1983), we suspect that in both instances the fungus was *A. apis* sensu Skou (1972). Baker and Torchio (1968) did not establish reproductive isolation in their taxa, and *A. major* sensu Skou (1972) has not been observed in North America since 1965. Chalkbrood had been recorded in association with wild bees twice prior to 1965 -- in England, Melville and Dade (1944) reported finding the fungus with the dead pupa of a leafcutting bee (*Megachile* sp.) and Clout (1956) reported it from the nest of *Osmia rufa* L.

The first records of chalkbrood in honey bees in North America were: 1) diagnosis in 1968 of the disease in a honey bee larva from Tehama County, California (Thomas & Poinar, 1973), 2) a carefully documented epizootic in California in 1970 and 1971 (Thomas & Luce, 1972), 3) identification of the disease in Nebraska and Wyoming in 1971 (Hitchcock & Christensen, 1972; Christensen & Gilliam, 1983), and 4) a report of its occurrence in Canada in 1971 (Gochnauer et al., 1972). By 1975, chalkbrood was an established and common disease in honey bees in the United States and Canada (Menapace & Wilson, 1976; Nelson et al., 1977).

As the management of native and introduced species of wild bees for pollination has increased, chalkbrood also has become epidemic in those populations (Stephen et al., 1981). To date, it has been reported in two species of *Megachile* and in *Osmia*. Chalkbrood has not yet been reported in the native alkali bee (*Nomia melanderi* Ckll.), but may be present in soil nests (Skou 1972, 1975, 1982a; Batra et al., 1973). The disease has become a serious threat to the alfalfa leafcutting bee (*Megachile rotundata* [Fabr.]) (Stephen & Undurraga, 1978; Stephen et al., 1981). The disease first became apparent in *M. rotundata* in California in 1971 (Thomas & Poinar, 1973). By 1975 it was epizootic in managed leafcutting bee populations in California and Nevada, and it subsequently spread rapidly throughout western America; in 1977 there were reports of brood losses of more than 50% (Vandenberg & Stephen, 1982).

The incitants of chalkbrood are several species in the genus *Ascosphaera* Olive & Spiltoir (Skou, 1972, 1975, 1982a; Skou & Hackett, 1979). A few years after the earliest accounts of "*Pericystis apis*" (Maassen, 1913, 1916; Claussen, 1921), European workers (Maurizio, 1934; Prökschl, 1953) reported two forms of that species, which later became *Ascosphaera apis* (Maassen ex Claussen) Olive & Spiltoir and *A. major* (Prökschl & Zobl) Skou. According to Skou (1972), both species are pathogenic in larvae of the honey bee and much less frequently may attack *Megachile* larvae, perhaps primarily as facultative parasites. In his review of chalkbrood in honey bees, Bailey (1981) contends that *A. major* may be a "secondary invader of moribund larvae". Recently, five additional species in *Ascosphaera* have been described: *A. proliperda* Skou and *A. aggregata* Skou, incitants of chalkbrood in wild bees (*Megachile* species and *O. rufa*); *A. fimicola* Skou from the fecal pellets of wild bees; and *A. atra* Skou & Hackett and *A. asterophora* Skou, both apparently saprophytic but occurring with chalkbrood in leafcutting bees (Skou, 1972, 1975, 1982a; Skou & Hackett, 1979).

The study described here was undertaken to determine 1) the species of *Ascosphaera* present in North America and responsible for recent epizootics in honey bees and leafcutting bees, 2) distributions of the + and - mating types of *Ascosphaera apis*, and 3) strain compatibilities.

MATERIALS AND METHODS

Chalkbrood-diseased larvae (mummies) of honey bees and wild bees were acquired from bee inspectors and research scientists in various areas of the United States, Canada and Central America (Tables 1,3). Three to five black mummies from each sample were examined microscopically. Ascocarps (spore cysts in Skou, 1982b) on the surfaces of the mummies were scraped off and morphological features of the spores, spore balls and spore cysts were noted in detail. Whole mummies were mounted on studs and gold-coated for examination under the scanning electron microscope (SEM) to observe ornamentation of the cyst wall (Skou, 1972; Stephen et al, 1981).

Subsequently, additional black mummies from each sample were separately crushed and placed in 10 ml of sterile distilled water. Subsamples of 0.5 ml were plated in duplicate on Sabouraud's dextrose agar with two percent yeast extract (SDA). Following the general method of Thomas and Luce (1972), the SDA plates were placed in Torbal jars which were purged with CO_2 gas and then left with a slight positive pressure of CO_2. After 72 hours at 35°C, the plates were removed and incubated aerobically at 35°C. Fungal colonies developing after 5 to 7 days were isolated and identified. Suspensions of larval mummies of the leafcutting bee were incubated as described above on a V-8 juice medium (Kish, 1980) as well as on SDA. A soil cell, diseased adults, and larvae of the alkali bee (*N. melanderi*) from the state of Washington also were examined for *Ascosphaera* species using the general procedures already described.

In further attempts to grow the *Ascosphaera* from the *Megachile* mummies, 1-ml aliquots of suspensions of crushed mummies were inoculated into tissue culture flasks (5 ml volume) containing a monolayer of larval cells of *Aedes albopictus* (Skuse). A second 1-ml portion was inoculated into the tissue culture medium alone. All flasks were examined for evidence of growth of *Ascosphaera* using an inverted light microscope.

White mummies from honey bees were sliced into 8-10 pieces with a sterilized razor blade, and the sections were placed on malt extract agar acidified to pH 3.6 with lactic acid. These plates were incubated at 35°C and resulting colonies were transferred to tubes of malt extract agar. Mating type of hyphae growing from each section was determined by test-plating with known + and - cultures of *A. apis* (Christensen & Gilliam, 1983). Compatibility among strains and compatibility with a subculture of *A. apis* obtained from Bailey (1981) in Britain were determined similarly.

Interspecific fertility was examined by attempting matches of + and - strains of *A. apis*, *A. major* (CBS 686.71), and *A. proliperda* (CBS 687.71) in all combinations. Cultures of the latter species were obtained from the Centraalbureau voor Schimmelcultures (CBS) at Baarn, Netherlands.

The key to species uses our own observations and measurements of *A. apis* in mummies and in culture, *A. aggregata* in mummies, and *A. major* and *A. proliperda* in culture. In addition, it incorporates data from the comprehensive studies by Skou and co-workers (Skou, 1972, 1975, 1982a; Skou & Hackett, 1979); the synoptic features for *A. atra*, *A. fimicola*, *A. asterophora* and *Bettsia alvei* in the key and in Table 4 are derived entirely from the detailed descriptions contained in those publications.

RESULTS AND DISCUSSION

Thirty-two samples with varying numbers of black and white mummies of the honey bee were received from 12 states, Canada and Guatemala. The results from our examination of 260 black mummies are shown in Table 1. All mummies were infected with *A. apis*. Although no other *Ascosphaera* species were recovered, several species in other genera grew from mummy pieces on SDA including

TABLE 1: *Ascosphaera* Species from Black Honey Bee Mummies.

Area	No. of samples	No. of mummies examined	Date collected	*Ascosphaera* species present
United States				
Arizona				
Casa Blanca	1	10	3/77	*A. apis*
Tucson	4	40	12/77, 6/78	*A. apis*
Yuma	1	10	3/77	*A. apis*
Florida				
Ft. Pierce	1	10	5/77	*A. apis*
La Belle	1	10	2/70	*A. apis*
Illinois				
Lombard	1	10	6/78	*A. apis*
Michigan				
Saginaw	1	10	6/78	*A. apis*
Nevada				
Reno	2	12	1970	*A. apis*
New York				
Ithaca	1	10	9/78	*A. apis*
Fishers	1	10	10/78	*A. apis*
North Carolina				
Mooreville	1	10	8/77	*A. apis*
Ohio				
Columbus	3	18	10/78	*A. apis*
Virginia				
Shenandoah Valley	1	6	1970	*A. apis*
Appomattox County	1	6	4/79	*A. apis*
Clark County	1	6	4/79	*A. apis*
Northampton County	1	6	9/79	*A. apis*
Warren County	1	6	4/79	*A. apis*
Washington				
Albion	1	10	7/78	*A. apis*
West Virginia				
Kearnsville	1	10	5/78	*A. apis*
Wyoming				
Laramie	1	10	9/78	*A. apis*
Canada				
Alberta	5	30	6/77	*A. apis*
Central America				
Guatemala	1	10	12/76	*A. apis*

Aspergillus flavus Link, a causative agent of stonebrood in bees.

All white mummies also were found to be infected with *A. apis* only. Mating type occurrences are shown in Table 2. The mating type distribution shown in Table 2 is very similar to that reported by Christensen & Gilliam (1983) for larvae collected in the early 1970's. In both surveys, number of larvae infected by *A. apis* + only has been 1.6-3.3 times the number infected with - only. Possible explanations for mummies containing a single mating type are: 1) the larva ingested one spore or was invaded by the hyphae from one spore; 2) the larva ingested many spores which germinated, but one mating type was more vigorous and superseded the other (Christensen & Gilliam, 1983); 3) one mating type had an advantage over the other as a result of particular external conditions; 4) a range of conditions in the gut favored growth of one mating type or the other (Christensen & Gilliam, 1983); and 5) the source of infection was mycelium of the observed mating type (Bailey, 1981). Twenty-nine percent of the mummies had both mating types; although the fungus had failed to sporulate in the larva, cysts and spores did develop on artificial media. Perhaps nutrient requirements, competition with secondary invaders, microenvironment within the larva, age of the larva at infection or death, or the length of time the mummy is left in the hive influences the ability of the fungus to complete its life cycle. At present, our meager

TABLE 2: Mating Types of *A. apis* in White Honey Bee Mummies.

Sample	No. of mummies examined	+ mating type only	- mating type only	Both
United States				
Arizona	18	6	6	6
Florida	7	1	0	6
Illinois	5	2	1	2
Michigan	6	3	1	2
Nevada	6	2	1	3
New York	10	5	2	3
North Carolina	7	2	3	2
Ohio	5	2	2	1
Virginia	8	6	2	0
Washington	15	10	5	0
Wyoming	7	2	3	2
Canada				
Alberta	6	3	1	2
Central America				
Guatemala	7	3	2	2
Total	107	47	29	31
Percentage		43.9%	27.1%	29.0%

knowledge of the processes of spore germination, growth and interaction of mating types, and maturation of the fungus in the larva has hampered both understanding of the fungus and progress toward development of control measures (Gilliam, 1978; Gilliam et al., 1978; Bailey, 1981).

All cultures from the white mummies were compatible with one another and with the *A. apis* obtained from England. This finding also is in agreement with the report by Christensen & Gilliam (1983) of complete intraspecific compatibility in *A. apis*. If there are differences in strains of *A. apis* from different parts of the U.S., Canada, Guatemala and England, they are not evident in either morphology or ability to mate. None of the cultures of *A. apis* mated with *A. major* or *A. proliperda*, however, nor did those species mate with one another. Thus these three species of *Ascosphaera*, all heterothallic, are reproductively isolated taxa.

Thirteen samples of chalkbrood mummies of *Megachile rotundata* were examined from four states where that bee is managed as a pollinator. Microscopic examination revealed that all of the 221 mummies were infected with *A. aggregata* (Table 3). We did not obtain growth of that species on either SDA or the V-8 medium. In the tissue culture experiments, spores of *A. aggregata* germinated on the larval mosquito monolayer, perhaps in response to CO_2 stimulation (Kish, 1980), but there was not continued growth of the fungus here or on artificial media. In three instances, *A. apis* grew from all mummies examined in the given sample (Table 3). Thus, although the *Megachile* larvae apparently were colonized primarily by *A. aggregata*, *A. apis* was present as well as evidenced by its rapid growth from sections of mummies. *Ascosphaera apis* also was recovered from the soil cell of the alkali bee (*Nomia melanderi*), but the accompanying adults and larvae contained *Aspergillus flavus* with no evidence of *Ascosphaera*.

Of the four pathogenic *Ascosphaera* species described, only two, *A. apis* in *Apis mellifera* and *A. aggregata* in *Megachile rotundata*, are authentically known from North America thus far. Furthermore, as pathogens in nature, those two incitants of chalkbrood in North America do not appear to be cross-infective. In view of our demonstration of *A. apis* in *Megachile* and *Nomia* nests, earlier reports of its association with *Anthophora pacifica*, *Megachile* species and *N. melanderi* (Baker & Torchio, 1968; Batra et al., 1973; Gilliam, 1978), and the report of Vandenberg et al. (1980) of adherence of literally hundreds of thousands of *Ascosphaera* spores to the external surfaces of foraging leafcutting bees, however, it appears tenable that transmission of pathogens between honey bees and wild bees may occur when territories and food sources overlap.

Ascosphaera major was not found in either honey bees or leafcutting bees in the present study nor was *A. proliperda* isolated from any of the samples. The latter species, which incites a "chalk-brood-like" disease, is

TABLE 3: *Ascosphaera* Species from Leafcutting Bee Mummies (*Megachile rotundata*).

Area	No. of samples	No. of mummies examined	Date collected	*Ascosphaera* species present
Nevada				
Jungo	1	17	1978	*A. aggregata.*
Lovelock	2	34	1978	*A. aggregata;* *A. apis.*
Orovada	1	17	1978	*A. aggregata.*
Oklahoma				
Stillwater	1	17	1979	*A. aggregata.*
Oregon				
Umapine	2	34	11/78	*A. aggregata.*
Washington				
Lowden	1	17	10/78	*A. aggregata.*
Touchet	3	51	11/78	*A. aggregata.*
Touchet	1	17	11/78	*A. aggregata;* *A. apis.*
Warden	1	17	1978	*A. aggregata.*

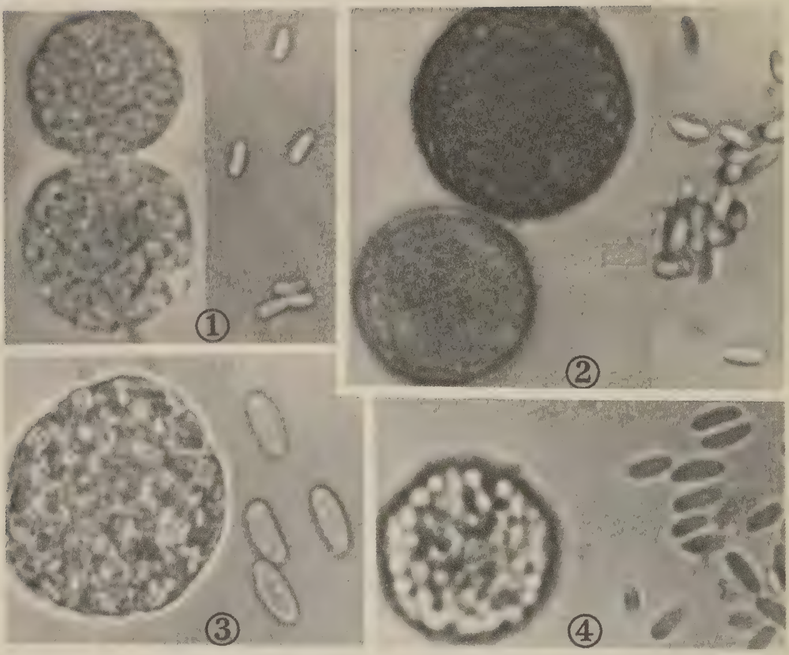
known only from Denmark from *Megachile centuncularis* L. reared in greenhouses (Skou, 1972).

The four pathogenic species in *Ascosphaera* differ frcm one another in spore size and shape (length/width ratio), ornamentation of the spore cyst wall, size of the spore cyst, and position of the spore cysts in relation to the larval integument. The surface of a black mummy infected with *A. apis* is a mixture of spore cysts and hyphae, and larvae mummified by *A. major* and *A. proliperda* also bear spore cysts superficially (Skou, 1972, 1975, 1982b). Larvae attacked by *A. aggregata* are very different in appearance in that the spore cysts are subcuticular (Skou, 1975, 1982b; Vandenberg & Stephen, 1982) and upon expansion rupture the surface of the mummy, hence the common name "ragged-brood disease" (Skou, 1982a). *Ascosphaera proliperda* can be distinguished easily from *A. apis* and *A. major* by its much larger spores (Table 4; Figs. 1-5) and its spore cyst wall which is ornamented with "confluent small and larger warts" (Skou, 1972). *Ascosphaera apis* and *A. major* differ in spore dimensions, spore length/width ratio, size of the spore cysts, and ornamentation of the spore cyst wall (Table 4; Figs. 1-5) (Skou, 1972, 1982b; Christensen & Gilliam, 1983).

The three apparently saprophytic species (*A. fimicola*, *A. atra*, *A. asterophora*) were not recovered or examined in this study, although both *A. atra* and *A. asterophora* have been isolated by others from the mummies or nests of leafcutting bees (*M. rotundata*) affected by *A. aggregata* (Skou, & Hackett, 1979; Skou, 1982a). The distinctive features for those three species are: 1) *A. atra* is homothallic with larger spores (up to 9 x 5 μm) than have been recorded in any other species in *Ascosphaera* (Table 4; Fig. 5);

TABLE 4: A Summary of Definitive Features and Occurrence for the Seven Species in *Ascosphaera*.

	Spore cysts	Sporeballs	Spores		Occurrence
			Dimensions	Length/Width ratio	
A. apis	80-82 µm (45-120)	12.5-15.6 µm (7-18)	2.8 x 1.4 µm (2-3.5 x 1-2.7)	2.0	Incites chalkbrood in the honey bee, *Apis mellifera*.
A. major	128-130 µm (59-250)	16.4 µm (9-24)	3.4 x 1.3 µm (3-4 x 1-1.5)	2.6	Incites chalkbrood in the honey and leafcutting bee, *Megachile centuncularis*.
A. aggregata	472 x 305 µm (140-545 x 100-382) subcuticular	17.1 µm (10-25)	4.6-5.2 x 1.9 µm (3.8-6.8 x 1.3-2.6)	2.6	Incites chalkbrood in *Megachile centuncularis*, *M. rotundata*, and *Osmia rufa*.
A. proliperda	134-155 µm (70-208)	17 µm (11-25)	5.5-5.7 x 2.4 µm (3.5-7.5 x 1.7-3.5)	2.2-2.4	Incites chalkbrood in *M. centuncularis*.
A. fimicola	64.2 µm (25-125)	10.3 µm (6-15)	3.7 x 1.7 µm (2.6-4.7 x 1.1-2.6)	2.2	Known only as a saprophyte on fecal pellets of *Osmia rufa*.
A. atra	54.4 µm (27-76)	12.7 µm (9-18)	7.3 x 3.6 µm (4-9 x 2-5)	2.0	Apparently a saprophyte, associated with pollen and *A. aggregata*-killed larvae in *M. rotundata*.
A. asterophora	93.2 µm (28-159)	19.3 µm (13-24)	4.6 x 1.3 µm (3-6 x 1-2)	3.5	Known only from *A. aggregata*-mummies; pathogenicity undetermined.



Figures 1-4. Spore balls and ascospores of the known pathogenic species in *Ascosphaera*. X 1500. Fig. 1. *A. apis*. Fig. 2. *A. major*. Fig. 3. *A. proliperda*. Fig. 4. *A. aggregata*.

2) *A. asterophora* is heterothallic and has pale yellow fusiform spores which are radiately-arranged in the spore balls (Skou, 1982a); and 3) *A. fimicola*, known only from the cells and pollen stores of *Osmia rufa* and not yet successfully cultured, has spores which are intermediate in size between those of *A. apis* and *A. major*, and those of *A. aggregata, A. proliperda* and *A. atra* (Table 4; Fig. 5). Additionally, *A. proliperda* and *A. atra* grow readily on standard agar media, whereas *A. aggregata* and *A. fimicola* fail to grow or grow ephemerally on such media (Skou, 1975; Kish, 1980).

The *Ascosphaera* species constitute a very interesting group of fungi primarily associated with bees. Further investigations on pathogenicity, host specificity, geographic distributions, and means of spread are needed and presumably will be forthcoming as investigators gain experience in species identifications and continue to develop *in vivo* techniques (Fichter et al., 1981; Vandenberg & Stephen, 1982).

The following key and Table 4 are presented in the ex-

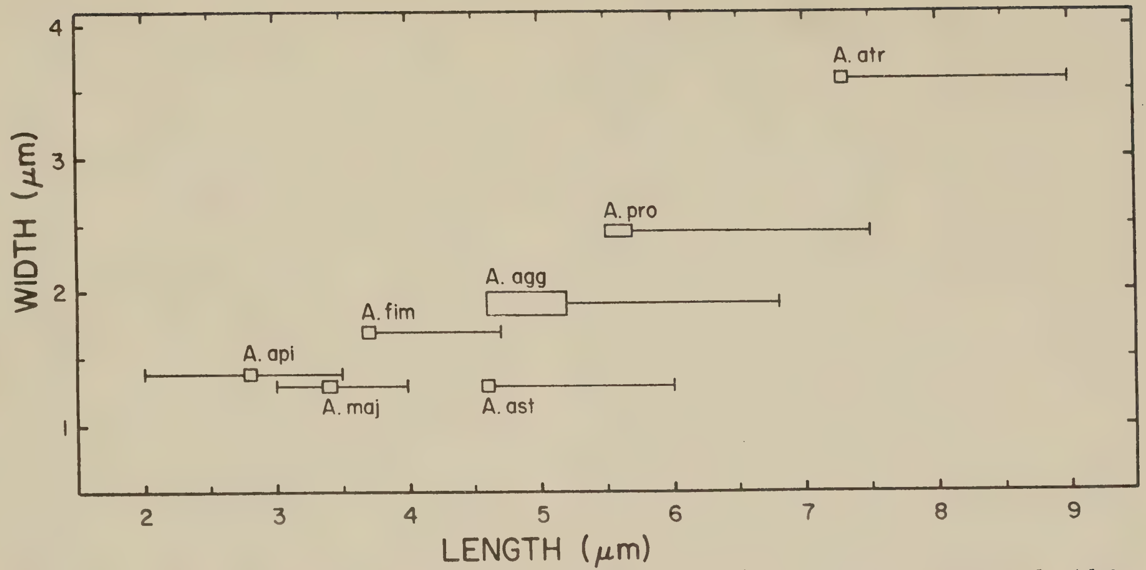


Figure 5. Spore dimensions for the 7 species in *Ascosphaera*. Mean length and width are shown by the symbol and maximum length is indicated by the line extending to the right. Length ranges are shown for *A. apis* and *A. major*. Additionally as an aid to identification: 1) *A. apis*, *A major*, *A. proliperda*, *A. asterophora* and *A. atra* grow readily on malt extract agar while *A. fimicola* and *A. aggregata* do not grow on standard media, and 2) considering the culturable species, only *A. atra* is homothallic (see text).

species in *Bettsia* and *Ascosphaera* (Ascosphaerales, sensu Skou, 1982b).

Key to Species in the Ascosphaerales

1. Spores spherical, not in spore balls; *Chrysosporium* conidial state. Saprophytic on pollen. . . . . *Bettsia alvei** (Skou, 1972, 1982b)

1. Spores elongated, in spore balls; conidial state unknown 2

   2. Spores no longer than 4.0 μm with an average length near 3-3.5 μm. Mainly pathogenic inciting chalkbrood in the honey bee, *Apis mellifera*. 3

   2. Spores up to 4.7 μm or more in length. Mainly associated with the leafcutting bee, *Megachile*, or mason bee, *Osmia*. 4

3. Spore cysts mostly near 130 μm in diam, range 59-250 μm. Rapid growth on most media . . . .*Ascosphaera major* (Skou, 1972, 1982b). Figs. 2, 5.

3. Spore cysts mostly near 82 μm in diam, range 45-120 μm. Rapid growth on most media. . . . . *A. apis* (Skou, 1972, 1982b). Figs. 1, 5.

   4. Spore average size 3.7 x 1.7 μm, range 2.6-4.7 x 1.1-2.6 μm; spore cysts globose, mostly near 64 μm diam, range 25-125 μm. Mainly saprophytic, associated with fecal pellets of the mason bee; has not been grown on artificial media. . . . .*A. fimicola* (Skou, 1975).

   4. Spores or spore cysts larger than above 5

5. Spore cysts oblong, large,subcuticular; spore average size 4.6 x 1.8 μm, range 3.8-6.8 x 1.3-2.6 μm. Mainly pathogenic inciting chalkbrood in the leafcutting bee, *Megachile*; in our experience, growth lacking or ephemeral on artificial media . . . . *A. aggregata* (Skou, 1975, 1982b). Figs. 4, 5.

5. Spore cysts globose. Mycelium culturable on most media 6

   6. Spore average size 4.6 x 1.3 μm, range 3-6 x 1-2 μm; spores several hundred per spore ball and radiately arranged about a hollow centrum, giving each spore ball a star-like appearance; spore cysts mostly near 93 μm in diam, range 28-159 μm. Known only from *Megachile* larvae killed by *A. aggregata*. . . . .*A. asterophora* (Skou, 1982a).

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* *Arrhenosphaera cranei* Stejskal (1974), reportedly an incitant of chalkbrood in honey bees in Venezuela, resembles *Bettsia alvei* in that both have conidial states. We agree with the comment (Skou, 1975) that verification of the Venezuelan fungus would be desirable.

6. Spores larger than above and not radiately arranged in the spore balls. 7

7. Spore average size 5.7 x 2.4 µm, range 3.5-7.5 x 1.7-3.5 µm; spore cysts mostly near 134-155 µm in diam, range 70-208 µm. Mainly pathogenic inciting chalkbrood in *Megachile centuncularis* . . . . *A. proliperda* (Skou, 1972). Figs. 3,5.

7. Spore average size 7.3 x 3.6 µm, range 4-9 x 2-5 µm; spore cysts mostly near 52 µm in diam, range 27-76 µm. Saprophytic, but often in nests of the leafcutting bee, *Megachile*. . . . *A. atra* (Skou & Hackett, 1979).

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LITERATURE CITED

Bailey, L. 1981. "Honey Bee Pathology." Academic Press, New York.

Baker, G. M., and Torchio, P. F. 1968. New records of *Ascosphaera apis* from North America. *Mycologia*, 60, 189-190.

Batra, L. R., Batra, S. W. T., and Bohart, G. E. 1973. The mycoflora of domesticated and wild bees (Apoidea). *Mycopathol. and Mycol. appl.*, 49, 13-44.

Christensen, M., and Gilliam, M. 1983. Notes on the *Ascosphaera* species inciting chalkbrood in honey bees. *Apidologie*, (in press).

Claussen, P. 1921. Entwicklungsgeschichtliche Untersuchungen über den Erreger der als "Kalkbrut" bezeichneten Krankheit der Bienen. *Arbeiten Biol. Reichsanst. Land-Forstw.*, 10, 467-521.

Clout, G. A. 1956. Chalkbrood and hunchback flies. *Bee Craft*, 38, 135.

Fichter, B. L., Stephen, W. P., and Vandenberg, J. D. 1981. An aseptic technique for rearing larvae of the leafcutting bee, *Megachile rotundata*. *J. Apic. Res.*, 20, 184-188.

Gilliam, M. 1978. Fungi. *In* "Honey Bee Pests, Predators, and Diseases" (R. A. Morse, ed.), pp. 78-101. Cornell University Press, Ithaca.

Gilliam, M., Taber, S., III, and Rose, J. B. 1978. Chalkbrood disease of honey bees, *Apis mellifera* L.: a progress report. *Apidologie*, 9, 75-89.

Gochnauer, T. A., Hughes, S. J., and Corner, J. 1972. Chalkbrood disease of honey bee larvae -- a threat to Canadian beekeeping? *Canada Agric.*, 17, 36-37.

Hitchcock, J. D. 1972. Chalkbrood disease of honey bees: a review. *Amer. Bee J.*, 112, 300-301.

Hitchcock, J. D., and Christensen, M. 1972. Occurrence of chalkbrood (*Ascosphaera apis*) in honey bees in the United States. *Mycologia*, 64, 1193-1198.

Kish, L. P. 1980. Spore germination of *Ascosphaera* spp. associated with the alfalfa leafcutting bee, *Megachile rotundata*. *J. Invertebr. Pathol.*, 36, 125-128.

Maassen, A. 1913. Weitere Mitteilungen über der seuchenaften Brutkrankeiten der Bienen. *Mitt. Kaiserl. Biol. Anst. Land-Forstw.*, 14, 48-58.

Maassen, A. 1916. Über Bienenkrankheiten. *Mitt. Kaiserl. Biol. Anst. Land-Forstw.*, 16, 51-58.

Maurizio, A. 1934. Über die Kalkbrut (Pericystis-Mykose) der Bienen. *Arch. Bienenk.*, 15, 165-193.

Melville, R., and Dade, H. A. 1944. Chalkbrood attacking a wild bee. *Nature*, 153, 112.

Menapace, D., and Wilson, W. T. 1976. The spread of chalkbrood in the North American honey bee, *Apis mellifera*. *Amer. Bee J.*, 116, 570-573.

Nelson, D. L., Barder, R. G., Bland, S. E.,Soehngen, U., and Corner, J. 1977. Western Canadian chalkbrood disease survey of honey bees, 1976. *Amer. Bee J.*, 117, 494-496; 505.

Prökschl, H. 1953. Beiträge zur Kenntnis der Entwicklungsgeschichte von *Pericystis apis* Maassen. *Arch. Mikrobiol.*, 18, 198-209.

Skou, J. P. 1972. Ascosphaerales. *Friesia*, 10, 1-24.

Skou, J. P. 1975. Two new species of *Ascosphaera* and notes on the conidial state of *Bettsia alvei*. *Friesia*, 11, 62-74.

Skou, J. P. 1982a. *Ascosphaera asterophora* species nov. *Mycotaxon*, 14, 149-159.

Skou, J. P. 1982b. Ascosphaerales and their unique ascomata. *Mycotaxon*, 15, 487-499.

Skou, J. P., and Hackett, K. 1979. A new homothallic species of *Ascosphaera*. *Friesia*, 11, 265-271.

Spiltoir, C. F., and Olive, L. S. 1955. A reclassification of the genus *Pericystis* Betts. *Mycologia*, 47, 238-244.

Stejskal, M. 1974. *Arrhenosphaera cranei*, gen. et sp. nov. a bee-hive fungus found in Venezuela. *J. Apic. Res.*, 13, 39-45.

Stephen, W. P., and Undurraga, J. M. 1978. "Chalkbrood Disease in the Leafcutting Bee." Oregon State University Agricultural Experiment Station Bulletin No. 630. Oregon State University, Corvallis.

Stephen, W. P., Vandenberg, J. D., and Fichter, B. L. 1981. "Etiology and Epizootiology of Chalkbrood in the Leafcutting Bee, *Megachile rotundata* (Fabricius), with Notes on *Ascosphaera* Species." Oregon State University Agricultural Experiment Station Bulletin No. 653. Oregon State University, Corvallis.

Thomas, G. M., and Luce, A. 1972. An epizootic of chalkbrood, *Ascosphaera apis* (Massen [sic] ex Claussen) Olive and Spiltoir in the honey bee, *Apis mellifera* L. in California. *Amer. Bee J.*, 112, 88-90.

Thomas, G. M., and Poinar, G. O., Jr. 1973. Report of diagnoses of diseased insects, 1962-1972. *Hilgardia*, 42, 261-359.

Udagawa, S., and Horie, S. 1974. Notes on some Japanese Ascomycetes XII. *Trans. mycol. Soc. Japan*, 15, 105-112.

Vandenberg, J. D., Fichter, B. L., and Stephen, W. R. 1980. Spore load of *Ascosphaera* species on emerging adults of the alfalfa leafcutting bee, *Megachile rotundata*. *Appl. Environ. Microbiol.*, 39, 650-655.

Vandenberg, J. D., and Stephen, W. P. 1982. Etiology and symptomatology of chalkbrood in the alfalfa leafcutting bee, *Megachile rotundata*. *J. Invertebr. Pathol.*, 39, 133-137.

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NOTICE

IMA AND IAPT SPECIAL COMMITTEE MEETINGS AT IMC$_3$

Meetings of the Nomenclature Secretariat of the International Mycological Association and of the Special Committee for Fungi and Lichens of the International Association for Plant Taxonomy were held during the Third International Mycological Congress in Tokyo, September 1 and August 30, 1983, respectively.

The IMA Nomenclature Secretariat requested formal disbanding of the Secretariat, since the IAPT Special Committee had previously agreed to assume the unfinished tasks of the Secretariat and to accept the reports of the few remaining Subcommittees that had been organized under the Secretariat. As of this writing, the IMA Nomenclature functions have been so transferred.

The IAPT Special Committee met to discuss its new format under the new regulations of the Nomenclature Secttion of IAPT and the Botanical Congresses. It also decided not to increase its membership from the 15 appointed at the Sydney Botanical Congress to the 18 it was so empowered to do (the 3 additional members were to have been nominated by the IMA Nomenclature Secretariat). Ronald Petersen announced his decision to retire as Secretary of the IAPT Special Committee for Fungi and Lichens, and nominations for a replacement were solicited at the meeting and by mail from all committeee members. Only two nominees were suggested, and when one of the nominees withdrew his name from consideration, the new Secretary of the Committee became, by default, Richard P. Korf, Plant Pathology Herbarium, Cornell University, Ithaca, NY 14853, USA. He assumed his duties December 1, 1983.

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STUDIES IN THE PEZIZACEAE. 1. INTRODUCTION. 2. PEZIZA APICULATA AND ITS RELATIVES

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The present paper contains the first two parts of a new series concerning the taxonomy of the family Pezizaceae. Part 1 deals with the general placement of the amyloid genera in the system of Pezizales. The new tribe Pachyelleae G. Hirsch trib. nov. is described in the Pezizaceae for the isolated genus *Pachyella* Boud.
In Part 2 a recent collection of the insufficiently known *Peziza apiculata* Cke. is described extensively. This species together with the related ones *P. thozetii*, *P. elachroa*, and perhaps *P. cornui* and *Aleurina subapiculata*, form a section of its own: *Peziza* L. sect. *Aleurodiscina* (Malençon) G. Hirsch comb. nov.

1. Nearly all contemporary authors accept a family Pezizaceae Fr. within the order Pezizales (Gamundi 1960, 1975; Dennis 1960, 1968, 1978; Maas Geesteranus 1967; Eckblad 1968; Rifai 1968; Kimbrough 1970; Korf 1972, 1973). The circumscription of this family Pezizaceae is different by the different authors. Some genera, for instance *Peziza* L., and, if acknowledged as different from *Peziza*, also *Plicaria* Fuck. and *Sarcosphaera* Auersw., are traditionally recognized by all authors as members of the family. Representatives of these genera have an ascus wall which is staining distinctive blue by use of iodine,

what means, it is amyloid. Other genera of the Pezizales which also have an amyloid ascus wall, like Ascobolus and Saccobolus, are classified as members of the family Ascobolaceae Sacc. The taxonomic position of still another number of genera has often changed, and some of them are sometimes placed in the family Pezizaceae, too. Such genera are, for instance, Thecotheus Boud. and Iodophanus Korf, which are included by Kimbrough & Korf (1967) in the family Pezizaceae, by others in the relationship of the Pseudoascoboleae. Other examples are Boudiera Cke. (cf. Dissing & Schumacher 1979; Hirsch 1980, 1983) and Pachyella Boud. The last mentioned genus was emended by Pfister(1973) and limited to species with amyloid ascus walls. Seaver (1928) and recently Donadini (1980) even want to unite this genus with Peziza s.str. This seems to me very inappropriate, because the species of Pachyella have some characteristic features which distinguish them clearly from the rest of the genera in the Pezizaceae:

- presence of hyphoid hairs which often form a tomentum on the ectal excipulum;
- presence of a gel inside the excipulum;
- inconstancy of ascus wall reaction with iodine (especially in European collections of Pachyella babingtonii);
- relatively thick walled ascospores.

I think that Pachyella occupies a rather isolated position in the family Pezizaceae. This should be reflected by the reservation of a tribe of its own for that genus:

Pezizaceae Fr. tribus Pachyelleae G. Hirsch trib. nov.

Apothecia pulvinata, discoidea. Asci operculati, octospori, parietibus in iodo caerulescentibus, sed reactio inconstans. Ascosporae hyalinae, crassitunicatae, laeves vel ornamentis cyanophilis ornatae. Excipulum pro parte gelatinosum, strato superficiale pilis hyphoideis.
Genus typicum (et unicum): Pachyella Boud.

Eckblad (1968) - following such authors as Dennis (1960) and Maas Geesteranus (1967) - has widened the circumscription of the family Pezizaceae also for inamyloid genera. He likes to include Marcelleina Brumm., Korf & Rifai (= Pulparia Karst.) in this family, because of the superficial resemblance of the species of that genus to typical amyloid roundspored members of the family Pezizaceae. This opinion was not followed by any other author. The genera Psilopezia Berk. and Discomycetella Sanwal also recognized by Eckblad (loc. cit.) as members of the Pezizaceae, certainly do not belong to the relationship of the true pezizoid fungi, as was pointed out by Kimbrough (1970) and Pfister (1973).

The genus Gelatinodiscus Kanouse & A.H.Smith - by Rifai (1968) and Korf (1972) treated as a member of the Pezizaceae, too - is now considered as inoperculate. It belongs to the Helotiales (Carpenter 1976).

Brummelen (1981) suggested in his search for evolutionary lines among the Pezizales based on the ultrastructure of ascus wall and apex, that the amyloid genera "...form a compact and closely related group..." in the Pezizales (p. 46). This opinion is chiefly supported by the results of the papers by Samuelson (1978a, b), which were not analyzed yet in the review of Brummelen (loc. cit.).

On the basis of these studies and former systematic suggestions, the amyloid genera should be kept as two separate families:

1. Ascobolaceae Sacc., with the tribes
   a) Ascoboleae (Ascobolus, Saccobolus)
   b) Iodophaneae Korf (Thecotheus, Iodophanus)
2. Pezizaceae Fr., with two tribes
   a) Pezizeae (Peziza, Plicaria, Sarcosphaera, Boudiera, Scabropezia, Ruhlandiella, Sphaerozone)
   b) Pachyelleae G.Hirsch (Pachyella)

This is essentially the system of Korf (1972 , 1973).

In the series of papers beginning with this article selected taxonomic and nomenclatural problems should be cleared up. It supersedes my contributions "Beiträge zur Kenntnis der Gattung *Boudiera*" in the scientific journal of the university of Jena (Hirsch 1980, 1983). Selected problems are the delimitation of genera and species, the variability of species, and the infrageneric arrangement of the genus *Peziza*.

2. The subject of this paper is *Peziza apiculata* Cooke. The following description of this very rare species is based upon an own collection of this fungus in the southern G.D.R. I have studied the material in fresh and in dried condition, and I hope to contribute towards a better knowledge of the variation range of this species.

PEZIZA APICULATA COOKE

in: Mycographia, p. 175, Pl. 79, fig. 305 (april 1877);
Michelia *1*: p. 71 (june 1, 1877).

Typus: Italy, Selva, in cortice putri abietino silva, August 1875, leg. P.A.Saccardo (holotype K).

Synonyms:
Phaeopezia apiculata(Cke.)Saccardo ap. Vido in Michelia *1*: 594 (1879);
Aleuria apiculata(Cke.)Boudier in Hist.Class.Discom.d'Eur., p. 47 (1907);
Discina apiculata(Cke.)Seaver in Mycologia *13*: 170 (1921);
Galactinia apiculata(Cke.)Le Gal in Bull.Soc.Mycol.France *78*: 208 (1962);
Aleuria reperta Boudier in Bull.Soc. Mycol.France *10*: 64 (1894);
? *Peziza elaeodes* Clements in Bot. Surv. Nebraska *5*: 6 (1901).

Description of the material collected 1975 in the southern G.D.R.:

Apothecia gregarious, dark brown, with a distinct olivaceous tinge, outside of the same color, but olivaceous tinge not clear; outside surface and margin fine flocky; apothecia up to 1 cm in diameter, saucer-shaped, flat, attached to the substrate by a broad base, sometimes with an indistinct very short stipe.

Anatomy of the fruitbody: Hymenium 250 - 270 µm thick. Subhymenium 50 - 80 µm thick, consisting of compact short-celled textura angularis, cells up to 20 µm, isodiametric or elongated; medullary and ectal excipulum not clearly differentiated from each other, together about 550-600 µm thick; medullary excipulum of textura angularis, cells polyedric, of irregular shape, very compact, up to 40 µm diam.; ectal excipulum of textura angularis, too, cells slightly larger than in the medulla, radially arranged, but not very distinct, outermost cells something clavate.

Spores: juvenile spores hyaline, then yellowish, mature spores light brown; shape ellipsoid or elongated ellipsoid, with polar apiculi; apiculi colorless, pointed or sometimes blunt (broken?), straight or rarely curved, but also few spores without apiculi seen; number of apiculi usually 1 at each pole, but spores with 2-5 apiculi of different lengths also occur, rarely 1 greater apiculus and some elongated warts at one pole; apiculi up to 6 µm long; the shape of spores and apiculi agrees perfectly with the illustrations given by Le Gal (1941; fig. 4 / 8 and 9, p. 65) and Eckblad (1968; fig. 34c, p. 75). Ascospores ornamented with rounded, low, regular, isolated warts, which are clearly visible in optical section; warts and apiculi cyanophilous; juvenile spores with two oil guttules, which are not clearly detectable in the mature state, without de Bary - vacuoles; the spores measure (without ornament and apiculi) 18,7 - 22,5 x 8,1 - 9,4 µm; length/width ratio 2,1 - 2,7.

Asci cylindrical, something tapered towards the base, apex rounded to flat, eightspored, not protruding at maturity, operculate; wall region around the operculum strongly amyloid, contents of juvenile asci dextrinoid; 260 - 275 x 11 - 14,5 µm.

Paraphyses cylindrical, 5 - 6 µm thick, apex slightly enlarged up to 8 µm, straight, septate, with 2 - 3 septa in the upper 100 µm, lower part more densely septate; unbranched, hyaline to light brown.

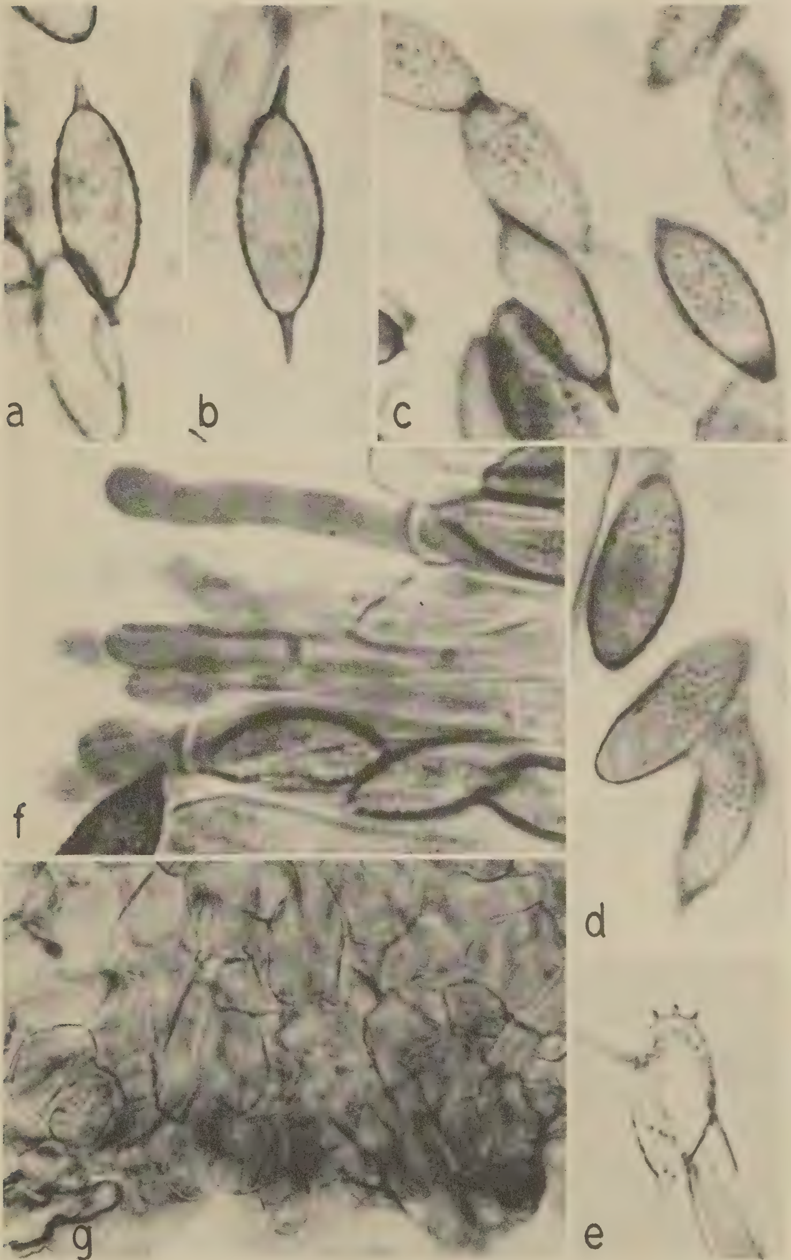
Collection examined: German Democratic Republic, District of Erfurt, Nature Reservation "Alperstedter Ried" 10 km N Erfurt; apothecia on rotten wood of a decidous tree (probably *Alnus*) in a very wet Alnetum; August 8, 1975; leg. et det. G. Hirsch; JE.

Peziza apiculata is a rare species. Only a few records were reported in recent times. After its original description by Cooke in 1877, which was based on a collection by Saccardo from northern Italy, Malençon (1939) was the first modern author who gave a description and reported a collection of *Peziza apiculata*. His material was from northern Africa, Morocco. Later, Gamundi (1960) reported the fungus from Argentine. But according to her description (nonamyloid asci, small ascospores) this report must be based upon another species. Eckblad (1968) had already reached the same conclusion.

Graddon (1960) has found the fungus in England. Moravec (1977) reports the fungus from a locality in Central Europe (Czechoslovakia) for the first time. A more recent record from England was provided by Legon (1979) and illustrated by Spooner (1981). Moodie (1982) reported a further British collection of *P. apiculata*.

According to Pfister (1979), Moravec`s collection from Moravia, Czechoslovakia, is not *Peziza apiculata* but belongs perhaps to a *Thecotheus* species. The illustration of Spooner (loc.

FIGURE 1. *Peziza apiculata*. a,b. Spores with apiculi. c,d. Ornamentation of the spores. e. Submature spore with 3 apiculi at one pole. f. Upper parts of paraphyses. g. Ectal excipulum. All in cotton blue, a-f X 1300, g X 520.


a
b
c
f
d
g
e

cit.) resembles the Moravec record in every respect, so that the true identity of the recent British collection of Legon remains, in my opinion, doubtfully. The apiculi of the ascospores as illustrated by Moravec and Spooner are very stout and thick at their bases, so they get a triangular shape in side view. This is, in fact, not the case in the true Peziza apiculata. Very well illustrations of the spores of this species were presented by Le Gal (1941, 1947), Eckblad (1968) and Donadini (1977).

The last mentioned author (Donadini 1977) has described the new variety P. apiculata var. flavobrunnea Donad. from southern France. It can be distinguished from the typical variety because of its yellowish colors in the hymenium. Donadini mentions some further collections of the typical variety from France (leg. Romagnesi, Nardi), which were partly recorded already by Grelet (1945). A much more recent collection from Corsica (Häffner 1983) is still doubtful.

The description of the anatomy in the fruitbody of P. apiculata in the present paper is tentative, because it is based on examination of the dried material. I tried to recollect the fungus in the same locality in later years, but without any success.

Peziza apiculata is known from northern Italy (locus typi), France, Morocco, Great Britain, and the G.D.R. The report from Czechoslovakia (Moravec 1977) is doubtful. Furthermore it occurs in North America. A report from South America, Argentine, by Gamundi (1960) is erronneous.

Aleuria reperta Boud. is sometimes kept as distinct from Peziza apiculata (Malençon 1939; Pfister 1979). Others, like Le Gal (1941, 1947, 1962) and Moravec (1977) consider Aleuria reperta Boud. as identical with Peziza apiculata. According to Donadini (1977) there is no authentic material of A. reperta preserved in the Boudier-Herbarium in PC. Pfister (1979) has summarized the "differences" between P. apiculata and A. reperta, following Malençon (1939). Aleuria re-

perta should have ascospores 22 - 23 x 9 - 11 µm, *Peziza apiculata* 17 - 20 x 9 - 10 µm. The measurements of ascospores given by Le Gal (1941) and of my own collection clearly mediate between these two extremes. The other differences in color (more light olivaceous in *A. reperta* - dark olivaceous brown in *P. apiculata*) and in gross morphology (substipitate apothecia in *A. reperta* - sessile ones in *P. apiculata*) are not sufficient for distinguishing these taxa at the species level. They shall not be taken into account any longer if one compares them with the description of my own collection given above. Consequently I believe, that *Aleuria reperta* Boud. is a synonym of *Peziza apiculata* Cke. and shall not fall into consideration any more when determination of recent collections of these fungi is necessary.

A similar but clearly different species is *Peziza thozetii* Berk., which was excellently described and illustrated by Rifai (1968). Its apiculi are more truncate, spore dimensions are greater than in *P. apiculata*, and the warts at the spore membrane are not rounded but elongated. The fungus, originally reported from Australia, was recently described from Papua New Guinea by Otani (1975), too. This extension of geographical range gives support to the opinion, that *Aleurina subapiculata* Hoehn. perhaps is identical with *P. thozetii*, as questionably indicated by Pfister (1979). However, the holotype of this species described from Java bears inamyloid asci as proofed by Pfister. Maybe this is caused by the kind of preparation.

A further species related to *P. apiculata* is *Peziza elachroa* Berk. & Curt. This species, known only from the type locality in Cuba (holotype K), has ascospores 16 - 18 x 10 - 12 µm ornamented with short, low, anastomosing ridges. Its apiculi are more truncate, blunt.

Peziza elaeodes Clements is according to the original description very similar to *P. apiculata* (Seaver 1928; Pfister 1978). No original material of this species seems to be in existence. It is here considered as questionably identical with

Peziza apiculata.

A further but very incomplete known species with affinities to *P. apiculata* is *Peziza cornui* (Boud.) Korf. This is indicated by the brownish, warty, apiculate spores. Spore dimensions are in the range of *P. apiculata*, but the thecium was said to be reddish purple-brown. It occurs on soil. According to Donadini (1977), no type material does exist in the Boudier-Herbarium (PC). So only fresh collections can help to clarify the question of specific distinctness of *P. cornui*.

Moravec (1974, 1977) has discussed *Peziza vagneri* J. Morav. in connection with *P. apiculata*. He believes, that these species are relatives. This seems, however, unjustifiable because *P. vagneri* is not truly apiculate. Its ascospores have some elongated warts at their poles as it is the case in some other *Peziza* species.

The same is meant for *Peziza bubacii* (Velen.) Svrček, a species with ± fusiform ascospores that are covered with irregular warts, something elongated at the poles, without true apiculi (cf. Svrček 1976, 1979).

The discussed species *Peziza apiculata* (incl. *Aleuria reperta* Boud., *Peziza elaeodes* Clem.), *Peziza thozetii* Berk., *Peziza elachroa* Berk. & Curt. and, perhaps, *Peziza cornui* (Boud.) Korf and *Aleurina subapiculata* Hoehn. form a group of naturally related species inside the genus *Peziza*. This was also the opinion of Donadini (1977), who erected the new section *Apiculatae* Donad. However, Malençon (1939) has already described a section *Aleurodiscina* Malenç. in the genus *Aleuria* with the species *Peziza apiculata* and *Aleuria reperta*. This is the first available name at the section level. For reasons of priority the correct name for the taxon in question should be:

Peziza L. sectio *Aleurodiscina* (Malençon) G. Hirsch comb. nov.

Basionym: *Aleuria* sect. *Aleurodiscina* Malençon in Bull.Soc.Mycol.France 55: p. 60 (1939).

Lectotype: *Peziza apiculata* Cooke

Synonym: *Peziza* sectio *Apiculatae* Donadini
in Bull.Soc.Mycol.France *93*: p. 180
(1977).

Further synonyms:
Peziza L. subgen. *Phaeopezia* Sacc. ap.
Vido in Michelia *1*: p. 594 (1879);
Phaeopezia (Sacc.) Sacc. ap. Vido
in Michelia *1*: p. 595 (1879);
Phaeopezia (Sacc.) Sacc. ap. Vido
subgen. *Geoscyphula* Sacc. in Bot.
Cbl. *18*: p. 218 (1884).

Apothecia small to medium sized, disc-shaped, saucer-shaped or flat. Thecium with brownish colors: yellowish, olivaceous or reddish brown. Ascospores hyaline to yellowish or brownish, usual with one apiculus at each pole, warted; apiculi and ornamentation cyanophilous. On bare soil or rotten wood.
After more material is available, the diagnosis of this section should be completed with features of apothecial anatomy.

To this section belong the following species of *Peziza*:

P. apiculata Cke. (+ var. *flavobrunnea* Donad.)

P. thozetii Berk.
P. elachroa Berk. & Curt.

and questionably
? *P. cornui* (Boud.) Korf
? *Aleurina subapiculata* Hoehn.

The recognition of a section of its own for the species related to *Peziza apiculata* seems well justified because of some remarkable features as there are the apiculate ascospores which often have brownish pigments. It is a necessary task to elaborate an infrageneric arrangement of the genus *Peziza* that can be recognized by most mycologists. But, in my opinion it seems to be much more difficult to fulfill this task among other groups of natural relationship within the genus *Peziza* than in the presented example.

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References

BRUMMELEN, J. van (1981): The Operculate Ascus and Allied Forms. In: Reynolds, D.R. (ed.): Ascomycete Systematics. The Luttrellian Concept. Springer: New York, Heidelberg, Berlin, pp. 27 - 48. -- CARPENTER, S.E. (1976): Taxonomy, morphology, and ontogeny of Gelatinodiscus flavidus Kanouse et Smith. Mycotaxon 3: 209 - 232. -- DENNIS, R. W.G. (1960): British cup fungi and their allies. London. - DENNIS, R.W.G. (1968): British Ascomycetes. Lehre. -- DENNIS, R.W.G. (1978): British Ascomycetes, Edit. 2. Vaduz. -- DISSING, H. & SCHUMACHER, T. (1979): Preliminary studies in the genus Boudiera, taxonomy and ecology. Norw. J.Bot. 26: 99 - 109. -- DONADINI, J.C. (1977): Deux discomycetes nouveaux: Peziza apiculata Cooke variété flavobrunnea nov. var. et Peziza muscicola nov. sp. Bull.Soc. Mycol.France 93: 177 - 187. -- DONADINI, J.C. (1980): Le genre Peziza (Dill.) Linné per Saint Amans sous-genre Pachyella (Boudier) nov.comb. Docum. Mycol. 11(41): 25 - 26. ECKBLAD, F.-E. (1968): The genera of the Operculate Discomycetes. Nytt Mag.Bot. 15: 1 - 191. -- GAMUNDI, I.J. (1960): Discomycetes operculados de la Argentina familias Pezizaceae y Humariaceae. Lilloa 30: 257 - 338. -- GAMUNDI, I.J. (1975): Fungi, Ascomycetes, Pezizales. Flora Cript. Tierra del Fuego 10(3): 1 - 185. -- GRADDON, W.D. (1960): British Records. Trans.Brit.Mycol.Soc. 43: 689 - 691. -- GRELET, L.J. (1945): Les Discomycétes de France d'après la classification de Boudier. Rev.Mycol. 10: 96 - 116. -- HÄFFNER, J. (1983): Die Pilze Korsikas. Studien über das Vorkommen höherer Pilze auf der Mittelmeerinsel Korsika. 1. Lieferung: Ascomyceten. 38 pp. Veröff. Verein Pilzk. Wissen. -- HIRSCH, G. (1980): Beiträge zur Kenntnis der Gattung Boudiera Cke. (Pezizales, Ascomycetes). I. Eine Boudiera-Kollektion aus der DDR und ihre Stellung zu den bisher bekannten Arten. Wiss.Z.Univ.Jena, Math.-nat. R. 29(4): 649 - 655. -- HIRSCH, G. (1983): Beiträge zur Kenntnis der Gattung Boudiera Cke. (Pezizales, Ascomycetes). II. Conspectus der Arten. Wiss.Z.Univ.Jena, Math.-nat. R., in press. -- KIMBROUGH, J.W. (1970): Current trends in the classification of Discomycetes. Bot.Rev. 36: 91 - 161. -- KIMBROUGH, J.W. & KORF, R.P. (1967): A synopsis of the genera and species of the tribe Theleboleae (= Pseudoascoboleae). Am.J.Bot. 54: 9 - 23. -- KORF, R. P. (1972): Synoptic key to the genera of the Pezizales. Mycologia 64: 937 - 994. -- KORF, R.P. (1973): Discomycetes and Tuberales. Chapt. 9 in: The Fungi: An Advanced Treatise. Ed. by G.C. Ainsworth, F.K. Sparrow jr. & A.S. Sussman. -- LE GAL, M. (1941): Les Aleuria et les Galactinia. Rev.Mycol. 6(Suppl. 3): 56 - 82. -- LE GAL, M.

(1947): Recherches sur les ornamentations sporales des Discomycetes operculés. Ann.Sci.Nat.Bot.Biol.Veget., Ser. 11, 8: 73 - 297. -- LE GAL, M. (1962): Combinaisons nouvelles concernant les genres *Galactinia*(Cooke)Boud. emend. Le Gal, *Scutellinia*(Cooke)Lamb. emend. Le Gal et *Sarcosoma* Casp. Bull.Soc.Mycol.France 78: 204 - 216. -- LEGON, N. W. (1979): Fungi from Norbury Park. Bull.Brit.Mycol.Soc. 13: 95 - 96. -- MAAS GEESTERANUS, R.A. (1967): De fungi van Nederland. 2a Pezizales deel I. Wetensch.Meded.Koninkl. Nederl.Natuurhist.Vereniging No. 69. -- MALENÇON, G. (1939): Champignons rare ou nouveaux du Maroc français. Bull.Soc.Mycol.France 55: 34 - 60. -- MOODIE, W.T. (1982): Spring Foray 1981. Forest of Dean 22 - 29 May. Bull.Brit.Mycol.Soc. 16: 12 - 21. -- MORAVEC, J. (1974): *Peziza vagneri* spec. nov. from Czechoslovakia (Discomycetes, Pezizales). Česká Mykol. 28: 223 - 226. -- MORAVEC, J. (1977): A new collection of *Peziza apiculata* in central Europe. Kew Bull. 31: 699 - 7o2. -- OTANI, Y. (1975): Some Discomycetes collected in Papua New Guinea. In: Reports on the Cryptogams in Papua New Guinea. Nat. Sci. Mus. Tokyo (pp. 5 - 41). -- PFISTER, D.H. (1973): The psilopezioid fungi. IV. The genus *Pachyella* (Pezizales). Can.J. Bot. 51: 2009 - 2023. -- PFISTER, D.H. (1978): Type studies in the genus *Peziza*. IV. Species described by F.E. Clements. Mycotaxon 7: 214 - 217. -- PFISTER, D.H.(1979): Type studies in the genus *Peziza*. VII. Miscellaneous species described by M.J. Berkeley and M.A. Curtis. Mycotaxon 8: 339 - 346. -- RIFAI, M.A. (1968): The Australasian Pezizales in the Herbarium of the Royal Botanic Gardens Kew. Verh.Koninkl.Nederl.Akad.Wetensch., Afd.Natuurk. 57: 1 - 295. -- SAMUELSON, D.A. (1978a): Asci of the Pezizales. I. The apical apparatus of iodine-positive species. Can.J.Bot. 56: 1860 - 1875. -- SAMUELSON, D.A. (1978b): Asci of the Pezizales. VI. The apical apparatus of *Morchella esculenta*, *Helvella crispa*, and *Rhizina undulata*. General discussion. Can.J.Bot. 56: 3069 - 3082. -- SEAVER, F.J. (1928): North American cup-fungi (Operculates). New York. -- SPOONER, B.M. (1981): New records and species of British microfungi. Trans.Brit.Mycol.Soc. 76: 265 - 301. -- SVRČEK, M. (1976): A revision of species of the genus *Peziza* Dill. ex St.Amans, described by J. Velenovsky II. Česká Mykol. 30: 135 - 142. -- SVRČEK, M. (1979): A taxonomic revision of Velenovsky's types of operculate Discomycetes (Pezizales) preserved in National Museum, Prague. Sborn.Narod.Muz.Praze 32 B (2-4): 115 - 194 ("1976").

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NOTICE

XIV INTERNATIONAL BOTANICAL CONGRESS

The fourteenth International Botanical Congress will be held in West Berlin, Germany, 24 July - 1 August 1987.

Pre- and post-Congress scientific field trips will be arranged to various parts of central, south, and north Europe. Brigette Zimmer convenes the Field Trip Committee.

The Nomenclature Section convenes in Berlin 20-24 July 1987, under the chairmanship of Frans A. Stafleu.

Six sections are arranged for the program: Metabolic Botany, Developmental Botany, Genetics and Plant Breeding, Structural Botany, Systematic and Evolutionary Botany, and Environmental Botany.

The first circular is available on request, and includes further details on the Congress and a preliminary reply form. An early enquiry and reply is requested. Send these to:

Congress Secretariat
XIV International Botanical Congress
Königen-Luise-Strasse 6-8
D-1000 BERLIN (West) 33
WEST GERMANY

MYCOTAXON

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MOLLICARPUS, GEN. NOV. (POLYPORACEAE) WITH NOTES ON *CORIOLOPSIS BYRSINA*, *PHELLINUS CROCATUS*, AND *POLYSTICTUS CROCATUS* VAR. *SIBIRICUS*

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Summary

Mollicarpus cognatus (type for genus) occurs in southeast Asia and has soft, lightweight basidiomes with relatively small spores and cyanophilous, typically dextrinoid binding hyphae. *Coriolopsis byrsina* is described and contrasted with *Phellinus crocatus*. *Phellinus crocatus* is neotypified. A piece of the presumed type of *Polystictus crocatus* var. *sibiricus* was located and found to be a *Phellinus*.

Many of the names in the *Coriolopsis* Murr. complex were proposed in the late 19th century and the published descriptions frequently lack the microscopic details that are, today, known to be significant in distinguishing species. Because few collections were available under most of the names it was difficult to circumscribe the species. Therefore, when one fungus, represented by several collections, could be readily separated from the complex but did not fit in a genus in several keys to the polyporoid genera (Cunningham, 1965; Pegler, 1973; and Ryvarden and Johansen, 1980), it was decided to propose a new generic name for it.

MOLLICARPUS, GEN. NOV.

Coriolopsis affin, differt sporis ellipticis late, (4-)4.6-5.2 X (3.2-)3.6µm et hyphis ligantis cyanophilus, typice dextrinoideus.
Typus: *Trametes cognata* Berk.

The genus *Mollicarpus* was segregated from *Coriolopsis* because the combination of short, broadly ellipsoid basidiospores with cyanophilous, typically dextrinoid binding hyphae which occur in the type and only species of *Mollicarpus* are not known to occur in *Coriolopsis*.

Mollicarpus cognatus (Berk.) Ginns, comb. nov. (Figs.1-2)
≡ *Trametes cognata* Berk., J. Linn. Soc. 16: 43. 1877.
= *Polystictus turgidus* Lloyd, Mycol. Writ. 7: 1193. 1923.

Basidiomes often perennial, effused-reflexed to dimidiate and applanate, 2.5-5.5 X 2-3 X 0.3-0.5 cm; pileus surface when fresh "uniformly cinnamon or fawn brown" (Corner, in herb.), drying Fawn Color (Ridgway 1912) or Tawny Olive on the older part and on the marginal area Tawny Olive to Wood Brown, dry, concentrically sulcate, soft, matted tomentose but irregularly roughened; context soft, densely cottony, Tawny Olive or Clay Color, homogeneous or duplex with a dark tomentum over a paler and denser hyphal layer, sections discoloring a pale red-brown in KOH, overall 1.5-4 mm thick; margin Warm Buff, sterile, acute, to 1 mm wide; tubes 5-8 per mm, up to 2 mm long, the mouths "white, when fresh" (Corner, in herb.), drying a Cinnamon Buff to Pinkish Buff, round to slightly angular, dissepiments

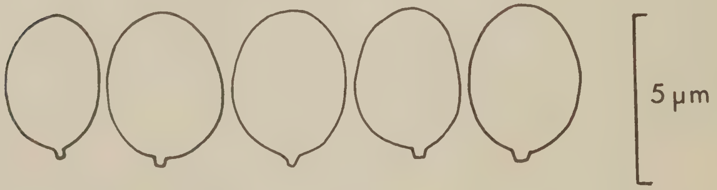


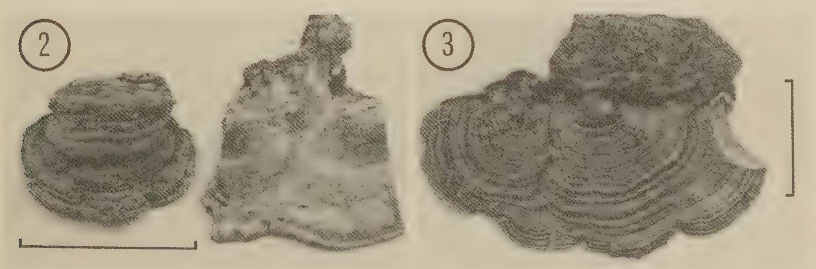
Fig. 1. *Mollicarpus cognatus*. Basidiospores from *Polystictus turgidus* type (K).

thin (50µm), edges granulose or weakly fimbriate, in vertical section Light Buff, firm, corky.

Hyphal system trimitic; hyphae not darkening in KOH; generative hyphae uncommon, with clamp connections, (1.8-) 3-4µm diam, the walls thin, hyaline, neither amyloid nor dextrinoid; skeletals in the context aseptate, (2-)3-4(-5)µm diam, wavy or straight, the walls pale yellow-brown to yellow, thin to 1.7µm thick, acyanophilous, nondextrinoid; binding hyphae in the trama serpentine, infrequently branched, (1.6-)2-3µm diam, the walls subhyaline to pale yellow, thickened, cyanophilous, dextrinoid (except in 14355); basidia not preserved; spores numerous in the collections studied, broadly ellipsoid, (4-)4.6-5.2 X (3.2-)3.6µm, the wall hyaline to pale yellow, thin, smooth, acyanophilous, nonamyloid, nondextrinoid.

Collected on rotting wood, the nature of the rot unknown. Four collections have been found, all are from southeast Asia (Indonesia: Aru Islands, 22 Sept. 1874, Challenger (*T. cognata*, type-K); British N. Borneo: Sandakan, Sept.-Dec. 1920, M. Ramos 2099 (*P. turgidus*, isotype-K); Malay Peninsula: Tambeling: Pahang, 19 Nov. 1930, E.J.H. Corner, Singapore Herb. 24461 (K); Philippines: Luzon: Nueva Vizcaya Prov.: near Dupax, Mar.-April 1912, R.C. McGregor, Bureau Sci. 14355(S)).

The light weight, the contrast between the dark context and pale tube layer, and soft texture of the



Figs. 2-3. Basidiomes. Fig. 2. *Mollicarpus cognatus*. Sulcate pileus (left) and pore surface (right). From 24461 (K). Fig. 3. *Coriolopsis byrsina*. Sulcate pileus. From 1664 (K). Scales equal 2 cm.

basidiomes are distinctive features of *M. cognatus*. *Coriolopsis byrsina* although of similar morphology is geographically isolated, occurring in the western hemisphere and Africa (see below). In addition, *C. byrsina* has larger spores (9.5-12μm long) and pores (4-5 per mm), and nondextrinoid hyphae.

The skeletal hyphae are readily distinguished from the binding hyphae in many species with a trimitic hyphal system. In *M. cognatus* these two types of hyphae are very similar. The binding hyphae were relatively narrow, restricted to the trama, branched occasionally and had walls which were dextrinoid (in most collections), cyanophilous and paler than those of the skeletal hyphae in the context.

Cunningham (1965, p. 239) listed *T. cognata* as a synonym of *Phellinus (Polyporus) bicolor* (Jungh.) Cunn. but I consider *Polyporus bicolor* to be a synonym of *Coriolopsis sanguinaria* (Kl.) Teng (see Ryvarden & Johansen 1980).

CORIOLOPSIS BYRSINA

Coriolopsis byrsina (Mont.) Ryv., Norw. J. Bot. 19: 230. 1972. (Fig.3)
≡ *Polyporus byrsinus* Mont., Ann. Sci. Nat., Ser. 2, 17: 126. 1842. (Also a few months later in La Sagra, Hist. Cuba 9: 391. 1842).
≡ *Polystictus crocatus* var. *byrsinus* (Mont.) Fr., Nov. Symb. Mycol. p. 91. 1855.
≡ *Polystictus byrsinus* (Mont.) Sacc., Syll. Fung. 6: 275. 1888.
≡ *Trametes byrsina* (Mont.) Pat. et Heim, Ann. Crypt. Exot. 1, Fasc. 3: 269. 1928.

Basidiomes typically reflexed with the effused part on a vertical surface, occasionally dimidiate, sessile and hemispherical (as seen from above), confluent, rather soft, coriaceous and very lightweight, 3-6(-10) X 2-3(-7) X 0.3 cm; pileus surface Clay Color to grey brown, concentrically sulcate, dry, soft to the touch, felty, dull; context Buckthorn Brown, duplex with a darker brown tomentum and a paler, denser hyphal layer above the tubes, soft, leathery-spongy, 1-3 mm thick; margin cream color, slightly darker than the tubes, sterile, matted-tomentose, to 1 mm wide; tubes 4-5 per mm, up to 1 mm long, round to angular, Pinkish Buff to Clay Color, in texture soft and felty to rough and rather coarse, the dissepiments thin with edges (the tube mouths) somewhat scalloped and smooth.

Hyphal system trimitic; generative hyphae uncommon, typically seen as small fragments, with clamp connections, 2-4µm diam, the walls thin to slightly thickened, hyaline to subhyaline; skeletal hyphae straight, unbranched or rarely branched, with retraction septa, (2-)3-6µm diam, the walls thin to 2µm thick, dark yellow to yellow brown, cyanophilous or acyanophilous, nonamyloid, nondextrinoid; binding hyphae rare to common, frequently branched, the walls thin to thick, subhyaline to pale yellow, nonamyloid, nondextrinoid, acyanophilous or cyanophilous, (1.5-)2-3µm diam; trama containing the three types of hyphae but each was narrower and of a paler color than in the context; basidia broadly clavate, 8-10µm diam and tapering rather abruptly to a narrow, stem-like base; spores ellipsoid with broadly rounded apices, slightly flattened on the adaxial surface, 9.5-12(-14) X (3.5-)4-5.5(-6.4)µm, the apiculus broad and blunt, the wall hyaline to subhyaline, smooth, thin, acyanophilous, nondextrinoid, nonamyloid.

Collected on the wood of angiosperms, associated with a white rot. Specimens have been seen from U.S.A. (Florida, South Carolina, Louisiana), Cuba, Mexico, Costa Rica, Guatemala, Nicaragua, Columbia, Bolivia, Brazil and Argentina; in Africa from Ghana, Kenya, Tanzania and Uganda. Also reported from Puerto Rico (Stevenson 1975) and Venezuela (Patouillard & Heim 1928).

The features which distinguish this apparently uncommon fungus are its effused-reflexed, extremly light-weight basidiomes, the strongly sulcate pileus, duplex context, large spores and occurrence in central and South America and Africa. Macroscopically *Mollicarpus cognatus* is similar but differs in having smaller spores (4.6-5.2 X 3.6µm), smaller pores (6-8 per mm) and it is known only from southeast Asia.

An unpublished herbarium name, *"Stereum malachodermus"* was applied by Fries to a specimen of *C. byrsina*

(Costa Rico, script E. Fries, Herb. Berkeley (K)) sent to Berkeley. The name was not published because Fries (1855) decided, wrongly, that the fungus was the same as *Stereum tenuissimum* Berk. (1847, p. 510) for he stated (1855, pp. 111-112) under *S. tenuissimum* "Synonymo Berkeleyi non cognito sub *St. malachodermo* distribui." The *S. malachodermus* collections from Costa Rica (above) and Cuba (Wright 364 & 365 at Kew) are also *Coriolopsis byrsina*. The Wright collections were cited by Berkeley (1868, p. 320). Berkeley thought *byrsinus* and *malachodermus* were only states of *C. occidentalis* (Kl.) Murr. and Patouillard and Heim (1928) referred to *P. byrsina* as a thin form of *C. occidentalis*. However, *C. occidentalis* differs in having spores 6-7 X 3µm, skeletals up to 10µm diam and a firmer basidiome.

Selected specimens studied: as *crocatus*: Mexico, script E. Fries (K), Mirador, Jan. 1843, Liebman (C); Costa Rica, Sydow, Fungi exotici exs. 552 (K); U.S.A.: Florida, Lowe 4158 (K); Columbia, 1664 (K); Guatemala, 4384, det. Lloyd (S); as *byrsinus*: Cuba, ex herbier Montagne, herb. Berkeley (K presumed isotype); Bolivia: Mapiri, Britton & Rusby 1324 (K); Nicaragua, U.S. Expl. Exped., herb. Hooker (K); Brasil: Est. Para: Ochioni, RBO. 706 (K).

POLYPORUS CROCATUS NEOTYPIFIED

Phellinus crocatus (Fr.) Ryv., Norw. J. Bot. 19: 234. 1972.
≡ *Polyporus crocatus* Fr., Epicrisis, p. 477. 1838.
≡ *Polystictus crocatus* (Fr.) Fr., Nov. Symb. Mycol., p. 91. 1855.
≡ *Coriolopsis crocatus* (Fr.) Murr., Bull. Torrey Bot. Club 32: 358. 1905.

Pertinent specimens examined: 1) "*Polyporus crocatus*, Epicr., Amer. boreal." (script E. Fries), "TYPUS! No specimens in Uppsala" (in pencil, author unknown to me), "Herb. Berkeley 1879." (by printed stamp). At K, herein designated neotype.
2) "*Polyporus crocato* affinis! Mexico. ...*Trametes*... affinis!" (script E. Fries), "Herb. Berkeley 1879" (by printed stamp). At K.

3) "*Polystictus crocatus*" (script E. Fries), "*Polyporus*? 27, Mirador, 1/43" (? script Liebman), with the additional data on the typed label: "TYPUS, AMERICA SEPT.- Mexico, leg. Liebman, januar 1843." At C.

Two taxa have been labelled *Polyporus crocatus* Fr. This unfortunate situation arose when Fries (1855) broadened his concept of *Polystictus crocatus* to include Montagne's *P. byrsinus*. Fries reduced *P. byrsinus* to a variety of *Polystictus crocatus* but Saccardo (1888, p. 275) rejected this varietal status and treated *P. byrsinus* and *P. crocatus* as distinct species. Saccardo (1888) noted, under *P. byrsinus*, that Fries' *P. crocatus* in Nov. Symb. Mycol. (1855) from Mexico was distinct from *P. crocatus* described in the Epicrisis.

In addition Fries labelled two specimens with the name *P. crocatus* and sent them to Berkeley. These specimens are now at Kew and are cited above as nos. 1 and 2. No. 1 is a *Phellinus* and had been, when I saw it in 1977, annotated as such by Ryvarden of Oslo. This concept was followed by Pilát (1942), Bondartsev (1953), Ryvarden (1972) and Ryvarden and Johansen (1980). Pilát and Bondartsev listed, without comment, *Polystictus crocatus* as a synonym of *Phellinus gilvus* (Schw.) Pat., whereas Ryvarden (1972) and Ryvarden and Johansen (1980) treated the name as *P. crocatus*.

Specimens 2 and 3 above are considered by me to be part of the same collection. They appear to be the Liebman collection from Mexico that Fries (1855, p. 91) cited. The fungus in these packets is *Coriolopsis byrsina*. After Fries (1855), this concept has been applied to *Polystictus crocatus* by Murrill (1905), Bresadola (1916, p. 223), Sydow (1927) and Overholts (1953). All, except Sydow, listed *Polyporus byrsinus* as a synonym. Murrill (1905) and Ryvarden and Johansen (1980) were of the erroneous opinion that *P. crocatus* was originally collected in Mexico.

Resolution of the problem lies in the designation of a type specimen. The protologue (Fries 1838, p. 477) gives only "In America boreali" as collection data for the specimen(s). Only one (no. 1) of the three specimens cited above carries this designation and it contains a specimen of a *Phellinus*. In the absence of any additional collection data, such as a date or collector's name, it is uncertain whether this is original material. It is designated neotype with the realization that it may be original material.

Ryvarden (1972), Ryvarden and Johansen (1980) and possibly Bresadola (1916) indicated that the type had been studied. Bresadola (1916) and Ryvarden (1972) did not include data on the specimen they considered to be type, give a description of it or cite the herbarium where it was stored. Thus they have not designated a neotype. Ryvarden and Johansen (1980) provided a description of *Phellinus crocatus*, cited the type as "K, C!", presumably meaning that a part was in each herbarium, and stated "We have only examined the type from Mexico." Having examined the three specimens cited above I was unsure of their intention. The specimens from Mexico, nos. 2 and 3 above, were collected in 1843 several years after the species had been described, thus cannot be holotype or lectotype. In addition, the original description gave America boreali as the locality, not Mexico. Fries did not submerge Mexico under the category America boreali when more specific data was available (e.g., Fries 1855).

The specimen, no. 1, herein designated neotype has the locality America boreali in agreement with the original description. This specimen, a *Phellinus*, was annotated by Ryvarden with data similar to that in the description in Ryvarden and Johansen (1980). It seems more than likely that this specimen was the basis for their description. Thus their miscitation of the herbaria and Mexican locality for the type are best considered a *lapsus calami*. If one interprets Ryvarden and Johansen's citation as having neotypified *P. crocatus* it creates the unnecessary situation of tying the species concept to the Mexican specimens at K and C (cited as type by Ryvarden and Johansen 1980). Since they are *Coriolopsis byrsina*, *C. byrsina* would become a synonym of *C. crocatus* then the specimen from America boreali would have to be described as a new species.

POLYSTICTUS CROCATUS VAR. *SIBIRICUS* SACC.

A piece of the presumed type (at S) (labelled in part: Sibiricae, prope Minusinsk. Ad truncos *Rosae Gmelin.* Comm. Saccardo) is, to me, *Phellinus ribis* (Fr.) Quél. Bondartsev (1953, p. 394) also recognized Saccardo's variety as *P. ribis.*

Acknowledgments: This study was initiated and essentially completed in 1977 while I was a visitor at the Royal Botanic Gardens, Kew. Every courtesy was extended to me by Dr. D.A. Reid, his colleagues and the staff.

LITERATURE CITED

Berkeley, M.J. 1847. Decades of fungi 15-19. Ceylon fungi. London J. Bot. 6: 479-514.

Berkeley, M.J. and M.A. Curtis. 1868. Fungi Cubenses (Hymenomycetes). J. Linn. Soc. 10: 280-341.

Bresadola, J. 1916. Synonymia et adnotanda mycologica. Ann. Mycol. 14: 221-242.

Cunningham, G.H. 1965. Polyporaceae of New Zealand. New Zealand Dept. Sci. Ind. Res. Bull. 164.

Fries, E. 1838. Epicrisis systematics mycologici. Uppsala.

Fries, E. 1855. Novae symbolae mycologicae. Nova Acta Regiae Soc. Sci., Upsala, Ser. 3, 1: 1-136.

Murrill, W.A. 1905. The Polyporaceae of North America-XI. A synopsis of the brown pileate species. Bull. Torrey Bot. Club 32: 353-371.

Overholts, L.O. 1953. The Polyporaceae of the United States, Alaska and Canada. Univ. Michigan Press, Ann Arbor. 466 p.

Patouillard, N. and R. Heim. 1928. Champignons recueillis par M. Mayeul Grisol dans le haut Orénoque. Ann. Crypt. Exot. 1, Fasc. 3: 266-278.

Pegler, D.N. 1973. Aphyllophorales IV: Poroid families. *In*: Ainsworth, G.C., F. Sparrow and A. Sussman (eds.), The fungi. Vol. 4B. Academic Press, N.Y.

Pilát, A. 1942. Polyporaceae I. *In*: Kavina, C. and A. Pilát. Atlas des Champignons de l'Europe. Vol. 3. Ser. B, Fasc. 42-48. pp. 473-624.

Ridgway, R. 1912. Color standards and color nomenclature. Publ. by the author. Washington, D.C. 43 pp. + LIII plates.

Ryvarden, L. 1972. A critical checklist of the Polyporaceae in tropical East Africa. Norw. J. Bot. 19: 229-238.

Ryvarden, L. and I. Johansen. 1980. A preliminary polypore flora of East Africa. Fungiflora, Oslo. 636 p.

Saccardo, P.A. 1888. Hymenomycetum. Sylloge Fungorum. Vol. 6. Part 2. Patavii.

Stevenson, J. 1975. Fungi of Puerto Rico and the American Virgin Islands. Contrib. Reed Herbarium 23. Baltimore. 743 p.

Sydow, H. 1927. Fungi exotici exsiccati. Fasc. XII. Berlin.

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A TUBER FROM NOVA SCOTIA

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The discovery of *Tuber dryophilum* Tul. & Tul. is of great interest to mycologists in Nova Scotia as this is the first record of a species in the Genus *Tuber* in the province. *Hydnotrya cubispora* (Bessey & Thompson) Gilkey is the only other member of the Tuberales reported from the region, S.N. Demmons (1974), C.O. Gourley (1983).

Cubical spores that appear to be *Hydnotrya* have recently been seen in the feces and stomach content of the Woodland Jumping Mouse, *Napaeozapus insignis* Miller, captured in Kings County. Other spores similar to those of the Tuberales also were seen.

Tuber dryophilum Tul. & Tul.
Fungi Hypogaei, p 147, pl 5, fig 34, pl 19, fig 8 1862.

Tuber unicolor Gilkey Mycologia 12:100. 1920.

Figs. 1-3

Ascocarp 0.5-2.3 cm in diam., many ± 1 cm, irregularly globoid to oblong, firm, solid, Sayal Brown (Ridgway, 1912; pl. XXIX) or slightly darker; surface finely roughened (under hand lens); periderm (225)270-360(420) μm thick, white with outermost coating colored, pseudoparenchymatous, compact to loosely and irregularly arranged, breaking at surface, hyphae 6-18 μm in diam., gleba with conspicuous white venae externae and brown venae internae; venae externae hyphae compact to loosely and irregularly arranged, branched, pseudoparenchymatous, originating from periderm; venae internae of thin-walled, irregularly arranged, densely compacted, narrow hyphae; asci 60-90 x 50-75 μm, irregularly arranged, irregularly subglobose to subellipsoid, short stipitate, 1-4 spored (generally 2-3), conspicuous, randomly scattered in gleba, separating easily from hyphae; spores 30-48(53) x 22-30(34) μm, golden-brown (under optical microscopic dark-field), ellipsoid, alveolate, sculpturing 4.5-5 µm high; (3)5-7(9) x (3)4-6(8) µm, across alveoli.

Habit and Habitat: Gregarious, on shaded lawn, in soil directly under sod layer, near a recently prepared flower bed. Neighboring trees were apple and willow.

Material Examined: ACAD 13999, Starr's Point, Kings Co., N.S.; first collected 17/08/81 by Jennie (Harrison) Sheito, more mature sporocarps collected on 02/09/81 by K.A. Harrison and J. Sheito.

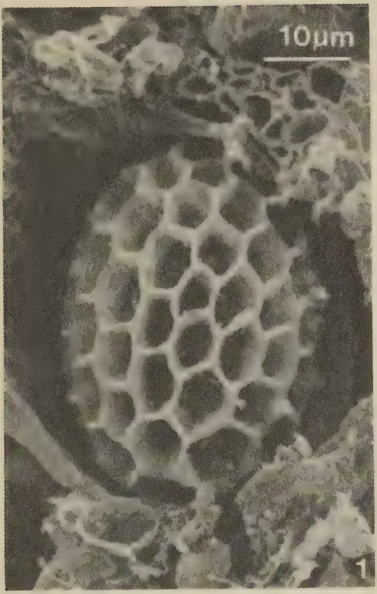
Collections are deposited in the herbaria of Oregon State College (OSC), Corvallis, Oregon, and in the E.C. Smith Herbarium (ACAD), Acadia University, Wolfville, N.S.

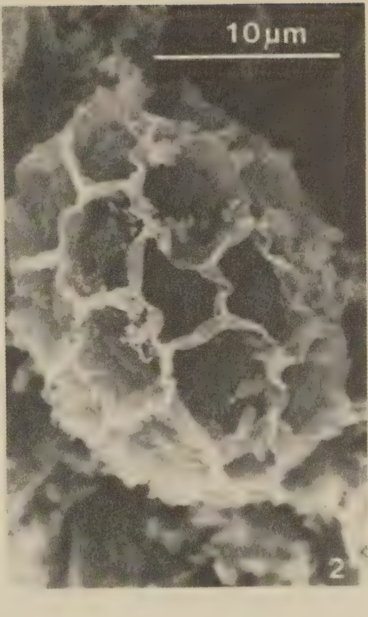
DISCUSSION

The habitat at Starr's Point is of historic interest as it was the site of the headquarters of the English regiments in the area after the expulsion of the Acadians in 1755. The old building and surroundings were for the officers. The grounds have some old English oak trees but is now mostly a tangle of vines, shrubbery, apple trees, maples and the stumps of huge old French willows, with remnants of acacias etc.

Tuber dryophilum is an old European species that has been reported from several places in the state of New York (Gilkey, 1939). Finding this species in these surroundings is consistent with a feeling that there are more species of Tuberales to be found in Nova Scotia once people are aware that such fungi exist in the region. This feeling is supported by investigations of European beetles found around certain parts that were obviously brought to the province in the ballast of ships which was dumped before onloading cargo for Europe. It seems highly likely that the materials dumped could have contained propagules of various European fungi.

Figs 1, 2 *Tuber dryophilum*. S.E.M. photomicrographs of ascospores showing alveolae and variations of ornamentation. Fig 3 Ascocarps, ACAD 13999, collected from Starr's Pt. Kings Co. N.S.





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We thank Dr. J. Trappe for the identification of this collection and to Dr. Robert Fogel who suggested that Dr. Trappe should be consulted as the spores were not typical for the present keys. Dr. Trappe said "It's spores tend to be somewhat longer and narrower and the gleba to have rather more inflated cells than is typical for the species as it occurs in Europe".

Scanning photomicrographs were taken on a JEOL JSM 25 located in the Department of Biology, Acadia University. Secondary electron images were recorded on Polaroid Type 55/PN 4x5 film. Coating was accomplished with a Technics Hummer II coater at three-minute pulse coating with gold/palladium at 200-300 Angstrom units of thickness. Spores were mounted on adhesive copper tape (3-M) directly from the dried sporocarps. The tape was glued to JEOL mounting stubs with Duco cement (Dupont product). Secondary electron images were made using 15 KV.

REFERENCES CITED

Demmons, Susan N. 1975. Nine species of Hypogeous Fungi found in Kings Co., Nova Scotia in 1974. B.Sc. with Honours Thesis, Acadia University (ined.).

Eidt, D.C. 1955. European Wireworms in Canada with particular reference to Nova Scotian infestations. Can. Ent. 85: 408-414.

Gilkey, H.M. 1939. Tuberales of North America. Studies in Botany I. Oregon State College, Corvallis, Ore.

Gourley, C.O. 1983. An Annotated Index of the fungi of Nova Scotia. Proc. N.S. Inst. Sci. 32(2/3): 1-295.

Ridgway, R. 1912. Color standards and color nomenclature. Publ. by the author. Washington, D.C. 43 p + 53 pl.

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CONIOCHAETA NEPALICA, A COMMON LONG ISLAND SOIL FUNGUS

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ABSTRACT

Two strains of a species of *Coniochaeta* routinely isolated from L.I. soils supporting oaks are shown to be identical to *C. nepalica* known previously only from its type locality in Nepal. Their morphology, hydrolase patterns and vitamin requirements are compared. A description of one strain is presented. The ascospores are shown to be constitutively dormant. Germination is induced by heat shock.

INTRODUCTION

A species of *Coniochaeta* has been routinely isolated on Long Island from weakly podzolic soils of forested areas containing oaks. The distinguishing feature is its narrow elliptical ascospores, reminiscent of those produced by *Xylaria* Hill ex Grev., but with a longitudinal germ slit. The ascospores are 8-10 µm long. The initial isolate was obtained during a study of the effects of chronic irradiation on the soil microfungi of an oak-pine forest at Brookhaven Laboratory, Suffolk County, L.I., New York. The Brookhaven strain was examined by Dr. Jack Rogers who pointed out its similarity to *Rosellinia xylarispora* (Cooke & Ellis) Sacc. (personal communication). Subsequently, the species has been obtained repeatedly from the oak-birch forest at Hempstead Lake State Park, Nassau County, L.I., New York. Two taxa with ascospores similar to the Long Island isolates recently have been described. *C. perangusta* Udagawa & Sugiyama with ascospores 11-14 µm long and with a longitudinal germ slit was obtained from a Nepal forest soil (10). Its authors believe it may prove to be identical to *Coniochaeta* sp. cfr. *Rosellinia xylarispora*, described by Munk (8) as an unidentified fungus on decorticated twigs of *Calluna* in Denmark. The two species are identical except that the latter is said by Munk to be without a distinct germ slit. *C. nepalica* Minoura, Morinaga & Muroi also described from Nepal soil has ascospores 8-10 µm long (7). It is identical to *C. perangusta* except for the smaller size of its elements. A new family, Coniochaetaceae, has recently been proposed to accommodate *Coniochaeta* and the related genus *Coniochaetidium* Mallock & Cain (6). A synopsis of the species in *Coniochaeta* is available (5).

In this paper the two Long Island strains are shown to be identical to *C. nepalica* based on a comparison of their morphology, hydrolytic patterns and vitamin requirements. A description of the Hempstead Lake strain is included as a supplement to the original (7).

Desiccated agar cultures of the Brookhaven and Hempstead Lake strains are deposited in The New York Botanical Garden Herbarium, Bronx, N.Y.

MATERIALS AND METHODS

Three strains of *C. nepalica* were examined in this study. The Brookhaven strain (ATCC 32351) originally was isolated from a L.I. irradiated oak-pine forest where it was most common in that section of the forest receiving the lowest radiation dose (2). The type strain (ATCC 36551) was obtained from a single soil sample from Nepal (7). The L.I. Hempstead Lake State Park strain was the most common sphaeriaceous fungus isolated from the A horizon of the oak-birch forest (11).

The description of the Hempstead Lake isolate and comparison of the morphology of the three strains is based on colonies grown on malt extract agar and cornmeal agar (9) at 20 C for 3 days (anamorph) or 30 days (teleomorph). Colors refer to plates in the Methuen Handbook of Colour (3).

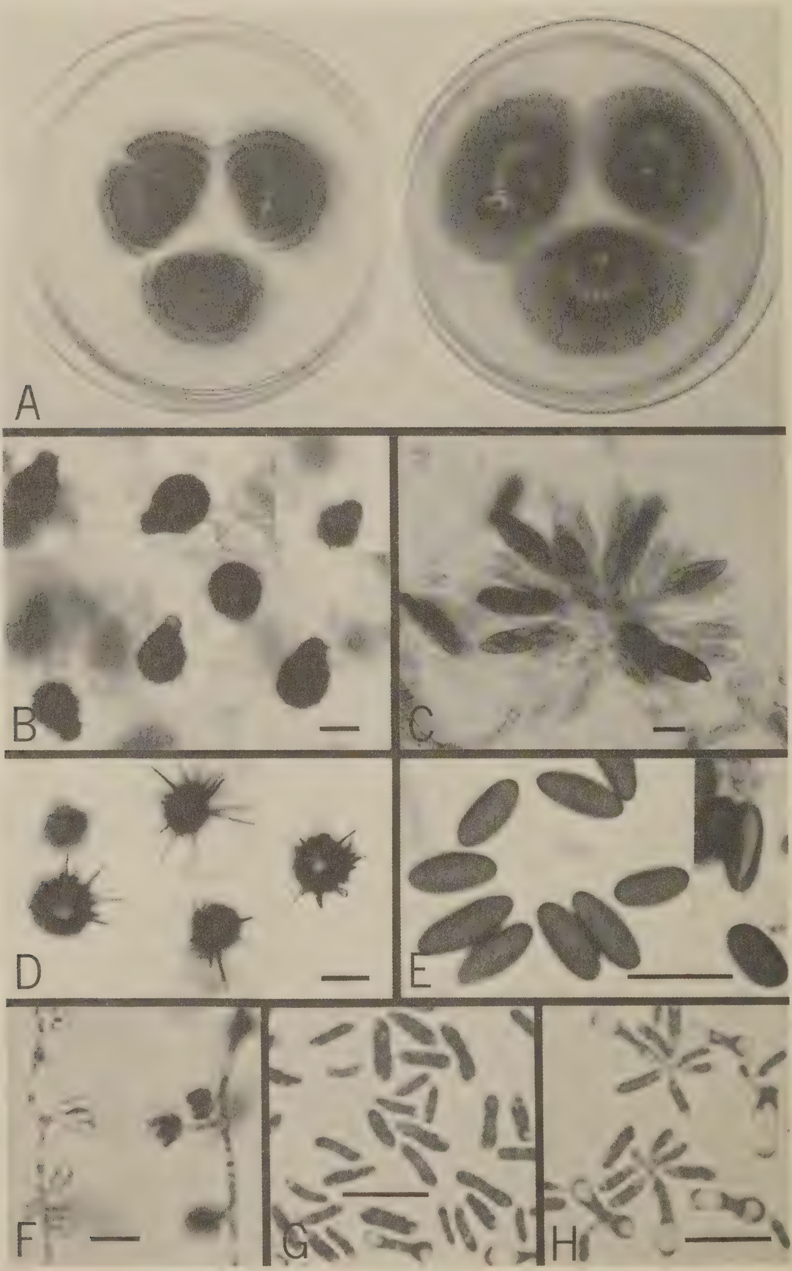
Hydrolase patterns were assessed using methods and substrates previously described (1). Inoculum consisted of small squares cut from the margin of young colonies grown on Bacto-Czapek-Dox Agar (Difco Laboratories, Detroit, MI). Cultures were inoculated in duplicate, incubated at 20 C and evaluated when colonies had radii of 2-3 cm. Six additional substrates were tested in the present study. These are, at the concentrations shown in parentheses, citrated rabbit plasma (0.5%, Bacto-Coagulase Plasma), inulin (0.5%, Fisher, Fair Lawn, N.J.), dextran (0.5%, m.w. 200,000-300,000, ICN, Cleveland, OH), sodium heparin (0.5%, ICN), arbutin (0.5%, ICN) and aesculin (0.5%, ICN). All substrates except the rabbit plasma were heat sterilized (121 C, 10 min). The rabbit plasma was rehydrated and used without further treatment. Hydrolysis of the latter was detected as a clear zone around a colony after precipitation of the residual substrate by an acidified mercuric chloride solution (15% HgCl in 20% HCL); of inulin, dextran and heparin by a 1% aqueous solution of hexadecyltrimethylammonium bromide; of aesculin by loss of fluorescence under black light; and of arbutin by the production of a brownish discoloration around the colony in the presence of ferric citrate (4).

The growth of the three strains in the absence or presence of biotin, thiamine, or biotin + thiamine was tested using Bacto-Vitamin Free Yeast Base plus sterile absorbant paper discs containing either, both, or neither of the above vitamins. The vitamin-free base was solidified with 2% Bacto-purified agar. Bacto-Yeast Morphology Agar which contains these vitamins served as the positive control medium. The inoculum consisted of a washed conidial suspension prepared as above from colonies grown on a vitamin-free medium. The cultures in duplicate were incubated at 20 C for 2 weeks.

The effect of heat on inducing germination was tested using the Hempstead strain. Both young (14 days old) and aged cultures (270 days old) were employed. An ascospore-conidial suspension was prepared by rubbing the surface of flooded slant cultures on MEA with an inoculating loop and was clarified to remove perithecia and hyphal fragments by passing it through sterile glass wool. The number of ascospores per ml was determined using a haemocytometer. The suspension was adjusted to deliver 20,000 ascospores/ml and then placed in a water bath at 60 C after first removing an aliquot to use as the non-heated control. One half ml was removed at various intervals of time, used to surface inoculate MEA plates, and then spread out with a sterile glass rod. Cultures were incubated at 30 C for up to 18 hrs. Per cent germination was based on four counts of 100 spores each per time interval.

MORPHOLOGY OF THE HEMPSTEAD ISOLATE

The Hempstead strain *C. nepalica* produces colonies on MEA (Fig. 1A) with a diam of 4-5 cm in 30 da at 20 C. The surface is appressed, strongly buckled and radiately wrinkled centrally, rusty-orange (7B8) but becoming black with maturation of the fruiting bodies. The colony reverse is black centrally becoming rusty-orange to pale orange (7A4) near the periphery. An amber (6B7) diffusible pigment colors the surrounding agar. Colonies on CMA (Fig. 1A) reach a diameter of 6-7 cm in 30 da at 20 C and are very pale orange (7A2). Aerial hyphae are lacking. Fruiting occurs within 14 da of inoculation at or below the agar surface with the ascocarps often concentrated in concentric bands. The mycelium is hyaline but becomes pale amber near the perithecia. It is composed of narrow hyphae of uniform width, 1.5-3.0 µm. The ascocarp initial is a small hyphal knot, 8-10 µm in diam, borne on a short lateral branch. The ascocarps are globose to subglobose (Fig. 1B), small, 65-75 x 90-110 µm rarely exceeding 100 µm, black by reflected light, glabrous or slightly hairy, ostiolate and ornamented with setae apically. The peridium is composed of 3-4 layers of dark brown, angular to elongate, parenchyma-like cells, 4-5 x 4-10 µm, with slightly thickened walls. Setae (Fig. 1D) are concentrated on one side of the ostiole, aseptate, very dark brown by transmitted light, 25-40 µm long, somewhat swollen at the base, 3-4 µm wide, tapering to a narrow point, 1 µm wide, with the wall over most of its length 1 µm thick and slightly irregular. Asci (Fig. 1C) are 25-35 µm p.sp. x 6-10 µm, clavate, short stipitate, 8-spored, non-amyloid, persistent, interspersed among hyaline, septate paraphyses. The presence of an apical ring is revealed using phase contrast optics. The ascospores (Fig. 1E) are 8.5-10.5 x 4-4.5 (-3) µm, biseriate,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narrowly ellipsoidal, sometimes collapsing and then producing a longitudinal furrow, medium brown by transmitted light, guttulate, and with an indistinct longitudinal germ slit. The anamorph (Fig. 1F) is produced quickly within 3 da of inoculation onto MEA or CM agar. Conidia are borne in moist clusters from short adelophialides 1-4 µm, longer true phialides 8-10 x 2-3 µm, or small openings in the cells of the hyphae. They are hyaline, unicellular, smooth-walled, oval, to cylindrical, to allantoid, variable in size, 4-5(-7) µm x 0.8(-2) µm (Fig. 1G). The larger conidia may produce secondary blastospores (Fig. 1H).

COMPARISON OF THE THREE STRAINS

Morphology.- The dimensions and morphology of the anamorphs of the three strains are identical. The teleomorph of the Brookhaven strain produces larger perithecia 110-150 x 110-120 µm and ascospores with a mean length (n=25) of 11.2 µm ± 0.9 s.d. but in all other regards is identical to the strains from Nepal and Hempstead Lake. Its dimensions lie between those of *C. nepalica* and *C. perangusta*. Colony morphology varies depending on the type of inoculum used but is similar for the three strains. On MEA, point inoculations using mycelium or conidia typically produce sterile colonies of white floccose-funiculose hyphae; mass inoculation of the entire surface with conidia yields light orange colonies with sparsely produced perithecia; ascosporic inocula give rise to brilliantly colored colonies and massive production of perithecia; aerial hyphae are suppressed.

Vitamin Requirements.- Behavior of the strains on the complete and vitamin-free media was identical. The three strains did not require exogenous vitamins for growth or production of the anamorph. The positive control medium used was not suitable for production of the teleomorph.

Hydrolase Patterns.- With the exception of inulin, the pattern of substrate hydrolysis for the three strains is identical although the intensity of the reaction on a substrate varies (Table I). Note for example the results with glycogen and cellulose. *C. nepalica* is among the most enzymatically versatile of the species tested from Hempstead Lake (1).

Fig. 1. *Coniochaeta nepalica.*

(A) Colonies on cornmeal agar (left) and malt extract agar (right) after 30 days at 20 C. (B) Perithecia. (C) Asci showing biseriate arrangement of ascospores.
(D) Perithecial setae. (E) Ascospores. Insert shows spore fractured so as to reveal the longitudinal germ slit.
(F) Anamorph on the surface of cornmeal agar.
(G) Phialoconidia. (H) Secondary conidia produced by budding of the phialoconidia. Bars represent 10 µm in C,E, F,G,H and 50 µm in B,D.

Table I. Comparison of substrates hydrolyzed by three strains of *Coniochaeta nepalica*.

Substrate		Strain	
	Hempstead Lake	Nepal ATCC 36551	Brookhaven ATCC 32351
Proteins			
Casein	+	+	+
Gelatin	+++	++	++
Plasma	++	+++	++
Albumen	-	-	-
Polysaccharides			
Amylose	++	++	+
Amylopectin	+++	++	++
Glycogen	+++	+	+
Inulin	-	-	+
Dextran	-	-	-
Cellulose	+	+	+++
Xylan	+	+	+
Pectin (pH 5.4)	++	+++	+++
Pectin (pH 7.2)	+	+	++
Heparin	-	-	-
Glycosides			
Arbutin	-	-	-
Aesculin	+	+	+
Esters			
Oil	+	+	++
DNA	+++	++	+++
RNA	-	-	-
Diphosphophenolphthalein	+++	+++	+++

Zones of clearing < 4 mm = +, 4-7 mm = ++, > 7 mm = +++.

ASCOSPORE GERMINATION AND CULTURE MAINTENANCE

Both young and aged ascospores of the Hempstead strain are constitutively dormant (Table II). The aged ascospores showed no decrease in their ability to germinate nor any change in dormancy but the aged conidia were non-viable. Heating the ascospores at 60 C for as little as 6 min induced germination; the conidia were rapidly killed at this temperature. Heat-shocked ascospores exhibit maximum germination after 12 hr at 30 C. The rate of germination was slower at 20 and 35 C. This species is the first *Coniochaeta* to be shown to require heat shock for ascospore germination (5).

Table II. Germination (%) of ascospores and conidia of *Coniochaeta nepalica* before and after heat treatment and rate of germination of treated ascospores (60 C for 15 min.).

Heated	Ascospores & Conidia 1) % G (18 hr)				Treated Ascospores			
60 C (min)	Ascospores (14d-old)	Ascospores (270d-old)	Conidia (14d-old)	Conidia (270d-old)	Time (hr)	% G 20C	30C	35C
0	0	0	90	0	4	0	0	0
6	79	76	<5	0	6	15	29	2
12	86	81	<1	0	8	35	59	13
18	85	87	0	0	10	52	75	38
24	82	85	0	0	12	66	86	71
30	84	86	0	0	14	79	88	77
					16	88	87	80

1) Incubated at 30 C.

Both the Brookhaven and Nepal strains as received from ATCC showed extensive aerial mycelium and poor perithecia production on MEA and CM. The Hempstead isolate derived from conidial or mycelial inocula showed the same loss of vigor after as few as two transfers. The strains are easily revitalized by using ascospore inoculum and heating at 60 C for 15 min to inactivate the conidia. In laboratory cultures prepared in this manner, no degeneration has appeared during the past six years.

ACKNOWLEDGMENT

I wish to thank Dr. John Cooke, University of Connecticut, Groton for reviewing this paper and Mrs. Barbara Dixon for typing the camera-ready copy.

LITERATURE CITED

1. Gochenaur, S. E. 1983. The fungi of a Long Island oak-birch forest. II. Population dynamics and hydrolase patterns for the soil penicillia. Mycologia: in press.

2. Gochenaur, S. E., and G. Woodwell. 1974. The soil microfungi of a chronically irradiated oak-pine forest. Ecology 55: 1004-1016.

3. Kornerup, A., and J. Wanscher. 1967. Methuen handbook of colour. 2nd ed. Methuen and Co., Ltd., London. 243 p.

4. Lodder, J., and N. J. W. Kreger-van Rij. 1952. The Yeasts. North Holland Publ. Co., Amsterdam. 713 p.

5. Mahoney, D. P., and J. S. LaFavre. 1981. *Coniochaeta extramundana*, with a synopsis of other *Coniochaeta* species. Mycologia 73: 931-952.

6. Malloch, D., and R. F. Cain. 1971. New cleistothecial Sordariaceae and a new family, Coniochaetaceae.

Canad. J. Botany 49: 869-880.

7. Minoura, K., T. Morinaga and T. Muroi. 1977. Some ascomycetes isolated from soil of Nepal (III). Trans. Mycol. Soc. Japan 18: 119-124.

8. Munk, Anders. 1957. Danish Pyrenomycetes. Dansk Bot. Ark. 17: 1-491.

9. Raper, K., and C. Thom. 1949. A manual of the penicillia. The Williams and Wilkins Co., Baltimore, Md. 875 p.

10. Udagawa, S., and Y. Sugiyama. 1982. New records and new species of ascomycetous microfungi from Nepal, a preliminary report on the expedition of 1980. Rep. Cryp. Study Nepal, Natl. Sci. Mus., Tokyo.

11. Zlattner, L., and S. Gochenaur. 198_. Fungi of a Long Island oak-birch forest. III. Distribution and survival of ascospores in the A-horizon. Canad. J. Microbiol. submitted.

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TWO NEW TRICLADIUM SPECIES FROM MOUNTAIN STREAMS

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Tricladium fallax anam. nov. (Fig. 1)
Etym: fallax = deceiving; concerns the striking similarity of conidia to another species of Tricladium Ingold.

Moniliaceae, Staurosporae

Coloniae in agaro maltoso 2% lente crescentes, albae, glabrae. Fructificatio in aqua: Conidiophora simplicia, ea lateralia usque ad 55 um longa, 3 um lata, apice annulata. Cellulae conidiogenae terminales, per cicatricem conidicam prolificantes. Conidia terminalia, solitaria; axis arcuatus vel sigmoideus, 59-90 x 2.5-4 μm, apice acicularis, basi primum truncatus, dein acicularis, 6-10 septatus, ramos duos, raro tres, antrorsos, 4-17 μm distantes, gerens. Ramus proximalis 30-50 x 2.5-4 μm, basi minus constrictus quam ramus distalis, apice acicularis, 3-6 septatus; ramus distalis 25-45 x 2.5-3.5 μm, 2-5 septatus, characteribus ceteris ramo proximali valde similis. Dehiscentia conidiorum schizolytica, cicatrix basalis lata.

Habitat: Slovakia septentrionalis, montes Vysoké Tatry, in rivulo parvo secus viam pedestrorum inter lacum Štrbské Pleso et vallem Mlynická dolina, prope hospitium "FIS" dictum, c. 1 350 m.s.m., ut conidia in spuma dispersa; 20.10.1980 leg. L. Marvanová.

Typus BRNU 498930, cultura viva CCM F-03380.

Colonies slow growing, smooth, whitish, with sparse aerial mycelium. Sporulation under water: Conidiophores simple, up to 55 um long when lateral, 3 um wide, annellate near apex (up to 6 rings seen). Conidiogenous cells terminal, integrated, proliferating percurrently, swelling near apex after release of each conidium, marking so each level of previous conidium formation. Conidia apical, solitary. Axis 59-90 x 2.5-4 um, broadest in the middle, bent or sigmoid, with sharp apex and base truncate immediately after release, becoming acicular after a time. Arms two,

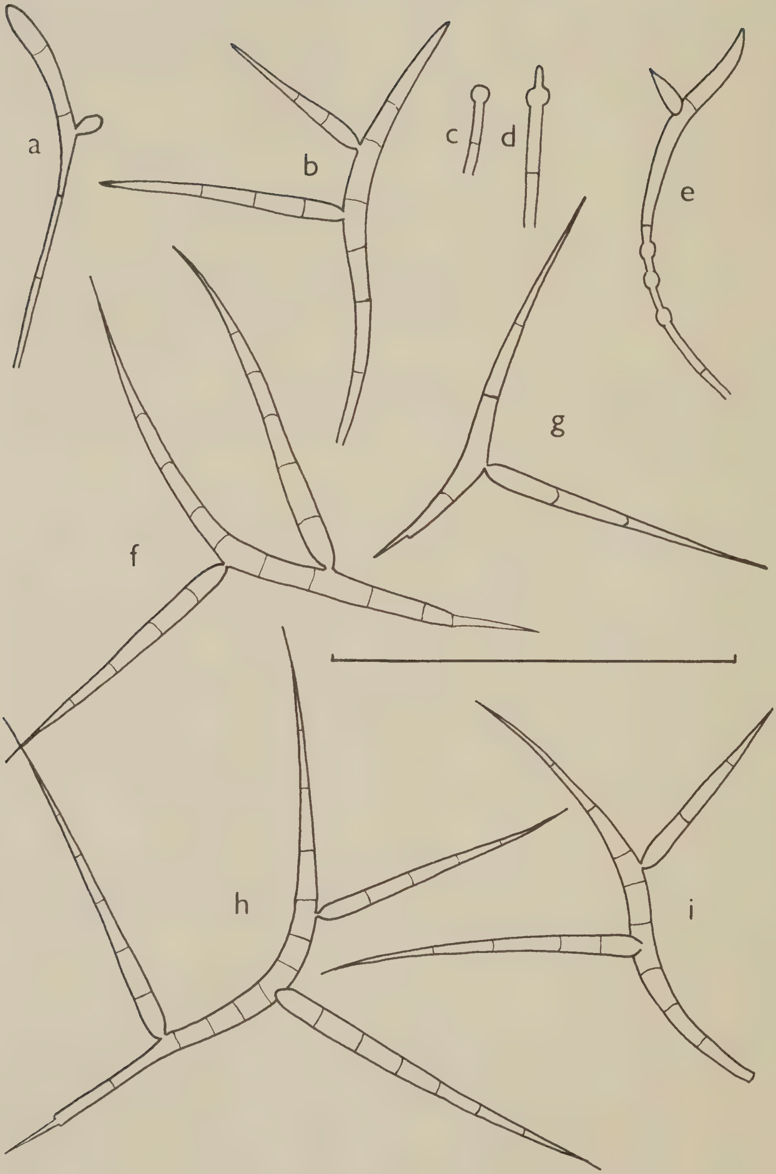

Fig. 1. Tricladium fallax CCM F-03380. (a,b) ontogeny of the first conidium; (c-e) ontogeny of second and subsequent conidia; (f-i) free conidia. Scale = 50 μm.

antrorse, constricted bilaterally at the point of insertion, acicular at the distal end. Proximal arm 30-50 x 2.5-4 μm, usually longer and less constricted at the base, 3-6 septate. Distal arm 25-45 x 2.5-3.5 μm, 2-5 septate, situated 4-17 μm apart from the proximal. Secession schizolytic, detachment scar broad. There is a marked tendency to elongation of all extremities of free conidia floating on the surface of stagnant water in culture. Occasional secondary branching may also appear under these conditions.

Conidia of this species were collected only once, in the type locality.

Distinguishing features: White colonies, percurrently proliferating conidiogenous cells and conidia with two arms markedly constricted at base.

There are four other taxa with similar conidia, the most close being *Tricladium attenuatum* Iqbal (1971). Nevertheless, this species has smaller and usually more straight conidia, which develop on branched conidiophores in groups of 2-3, simultaneously with the new conidiogenous cell.

The fungus originally described as *Ingoldia biappendiculata* Arnold (1970; = *Gyoerffyella biappendiculata* (Arnold) Ingold 1975), has markedly smaller conidia with arms rather perpendicular than antrorse. Conidiogenous cells have a swollen base and a narrower neck, which bears signs of proliferation intergrading between percurrent and sympodial. The more proper taxonomic classification of this fungus will be published later.

Tricladium splendens Ingold (1942), the type species of the genus, has also multiseptate conidia with arms markedly constricted at base, but this fungus differs by its dark, quickly growing colonies, and the conidia are much larger, with subulate, not acicular apexes. The percurrent proliferation exists, however, in both species. The teleomorph of *Tricladium splendens* is *Hymenoscyphus splendens* Abdullah et al. (1981). A microconidial state was reported for that species in culture (Descals et Webster 1982) and was observed in nature, too (Marvanová, unpublished). No microconidial state has been found with *Tricladium fallax* up to now.

Tricladium chaetocladium Ingold (1974) has similar thickenings on the conidiophore apex (Ingold, l.c. Fig. 1) indicating the probability of percurrently proliferating conidiogenous cells being involved. Nevertheless, the colonies of that species are dark and the conidia exceed in size these of *Tricladium fallax* considerably and differ in other details, too; namely in less frequent septation and much less constricted bases of conidial arms. The ends of conidial elements are obtuse, not acicular.

Tricladium robustum anam. nov. (Figs. 2,3)

Moniliaceae, Staurosporae

Coloniae in agaro maltoso 2% celeriter crescentes, melleae, in parte reversa brunneae. Fructificatio in aqua, status macroconidicus: Conidiophora simplicia, terminalia; cellulae conidiogenae apicales, prolificatio non visa. Conidia terminalia, solitaria, ex axe et ramis 2-3(4) in successione basifugali ecrescentibus consistentia. Axis clavatus, 80-190 x 3.7-8 µm, apud insertionem ramorum flexus, paulo attenuatus in internodiis, basi truncatus dein conicus, apice subacute rotundatus. Rami 30-70 x 7-10 µm, stricti, antrorsi, conici vel in parte centrali paulo inflati, late adnexi vel basi subconstricti, apice subacute rotundati, 6-20 µm mutue remoti. Conidia tota dense septata, cellulis ramorum saepe subinflatis. Conidiarum dehiscentia schizolytica, sed conidia tarde liberantur. Status microconidicus: Conidiophora longa, apice ramosa, cellulas conidiogenas phialiformes 8-10 x 3-4 um gerentia. Conidia rotundata vel pyriformia, hyalina, c. 3-5 um in diam.; germinatio non observata.

Habitat: Moravia septentrionalis, montes Hrubý Jeseník, loco humido prope rivulum Keprnický potok sub monte Točník, c. 600 m.s.m., ad folia putrescentia Fagi sylvaticae, 29.11.1977 leg. L. Marvanová.

Typus BRNU 498931, cultura viva CCM F-03177.

Colonies quickly spreading, white, becoming honey (Rayner 1970, 64"), brown from below, cottony in the centre, funiculose after longer cultivation. Sporulation in water, macroconidial state: Conidiophores apical, simple. Conidiogenous cells apical, integrated. Conidia apical, solitary, consisting of one axis and usually 2-3(4) arms appearing in basifugal succession. Axis clavate, 80-190 x 3.7-8 µm, bent award at each point of branch insertion, with slightly narrowed internodes; base truncate, becoming blunt conic, apex obtuse. Branches 30-70 x 7-10 µm, straight, antrorse, conic or slightly inflated in medial part, with broad or somewhat constricted base and obtuse apex, situated 6-20 µm apart. The whole conidium is densely septate, with cells in branches sometimes slightly inflated. Dehiscence of conidia schizolytic and late, detachment scar broad. Proliferation not seen. Microconidial state: Conidiophores with simple long stalk and penicillately branched apex. Conidiogenous cells phialidic, 8-10 x 3-4 µm; conidia rounded to pear-shaped, hyaline, c. 3-5 µm in diam., not germinating.

This species tends to produce giant conidia in culture, with axis up to 300 µm long and loosely arranged branches.

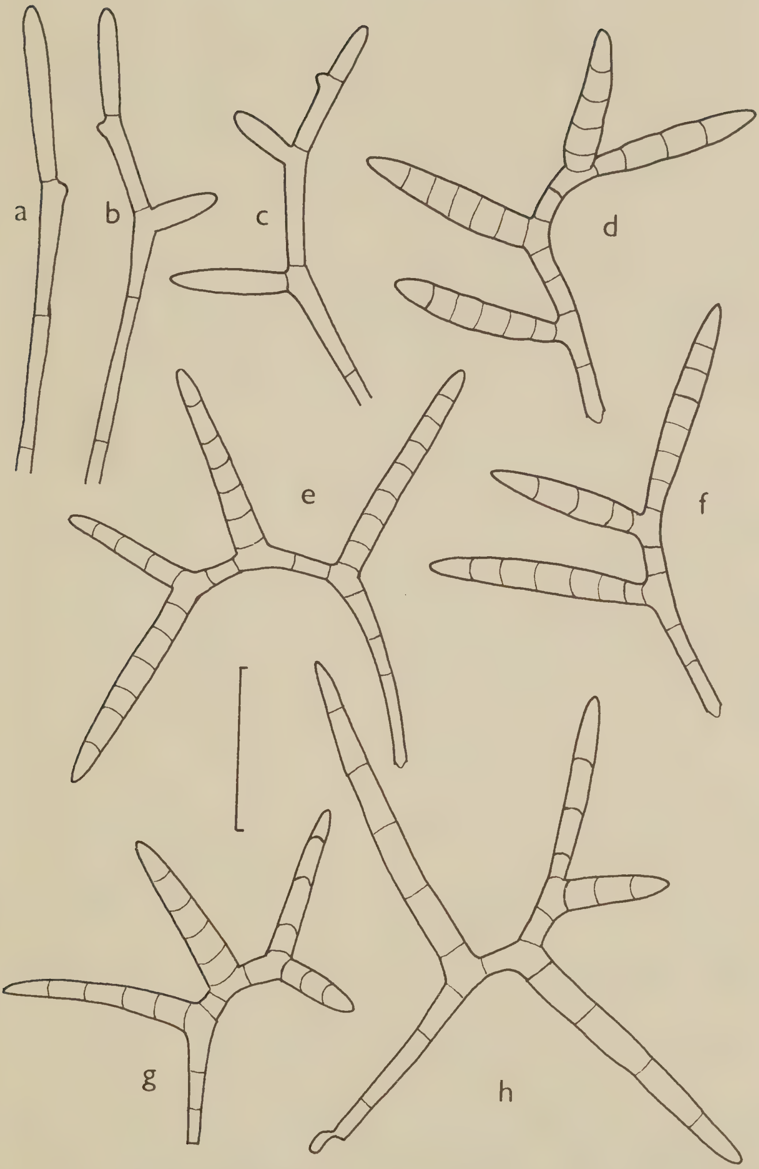

Fig. 2. Tricladium robustum. (a-c) conidial ontogeny; (d-h) free conidia. (a-f = CCM F-03177, g-h = conidia from foam). Scale = 50 µm.

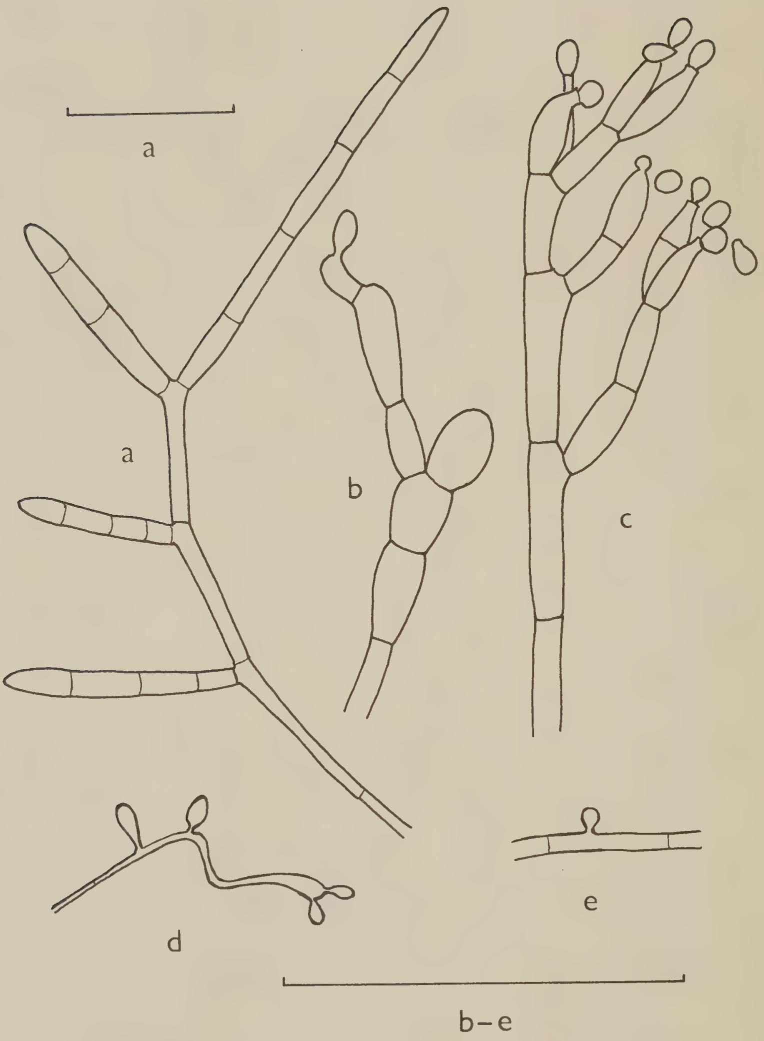

Fig. 3. Tricladium robustum CCM F-03177. (a) giant conidium from stagnant water; (b) chlamydospore-like cells appearing after long maintenance in distilled water; (c) phialidic microconidial state; (d,e) sessile blastoconidia (?). Both scales = 50 μm.

Beside the overall robust appearance of the conidia the most apparent feature is the thinner axis in contrast to the thick arms.

Conidia of this species were seen also in foam in the right tributary of the Látaná stream near its mouth, c. 1 000 m.s.m. in the Western Tatras, 17.7.1977.

This species is easily recognizable even as free conidia in foam and can hardly be confused with any other species, especially due to the size. Ingoldiella hamata Shaw (1972) shows an overall similarity with respect to the configuration of conidia and the proportions of axis and branches; nevertheless, this species is a basidio - mycete anamorph with clamps on conidia and its distribution is restricted to tropics.

The classification of Tricladium robustum may seem questionable as regard to the higher number of branches and a "scorpioid" axis. However, the genus Tricladium at present is an assemblage of mostly unrelated anamorphs joined on the basis of having conidia predominantly with one axis and two or more primary branches, which may branch again. This configuration is very simple and has probably been evolved by a wide range of fungi with ascomycetous, and a few with basidiomycetous, affinity. Even the application of numerical taxonomy (Marvanová 1983) did not help to divide this genus into well defined smaller units and therefore I prefer to retain the broader conception.

REFERENCES

ABDULLAH, S.K., DESCALS, E. et WEBSTER, J. 1981. Teleo - morphs of three aquatic hyphomycetes. Trans. Br. Mycol. Soc. 77:475-483.

ARNOLD, G.R.W. 1970. (On a new species of the genus Ingoldia). Nov. Sist. Nizh. Rast. 6:173-176.

DESCALS, E. et WEBSTER, J. 1982. Taxonomic studies on aquatic hyphomycetes IV. Pure culture and typification of various species. Trans. Br. Mycol. Soc. 79:45-64.

INGOLD, C.T. 1942. Aquatic hyphomycetes of decaying alder leaves. Trans. Br. Mycol. Soc. 25:339-417.

INGOLD, C.T. 1974. Tricladium chaetocladium sp. nov., an aquatic hyphomycete from Britain. Trans. Br. Mycol. Soc. 63:624-626.

INGOLD, C.T. 1975. An illustrated guide to aquatic and water-borne hyphomycetes (Fungi imperfecti) with notes on their biology. Scient. Publs. Freshwater Biol. Ass. No. 30, 96 pp.

IQBAL, S.H. 1971. New aquatic hyphomycetes. Trans. Br. Mycol. Soc. 56:343-352.

MARVANOVÁ, L. 1983. Concerning taxonomy of the genus *Tricladium*. Abstracts of papers delivered at the 7th Conference of Czechoslovak mycologists held in České Budějovice, 13-18th September, 1982. Č. Mykol. 37:108-128.

RAYNER, R.W. 1970. A mycological colour chart. Commonw. Mycol. Inst., Kew.

SHAW, D.E. 1972. *Ingoldiella hamata* gen. et sp. nov., a fungus with clamp connexions from a stream in North Queensland. Trans. Br. Mycol. Soc. 59:255-259.

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ETUDES DES TYPES DE PECK ET DE MURRILL APPARTENANT OU AYANT APPARTENU AU GENRE MELANOLEUCA *

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RESUME

88 espèces décrites par Murrill sous le nom générique de *Melanoleuca* et 43 espèces décrites par Peck et transférées dans ce même genre par Murrill et Singer sont briévement examinées. Parmi elles, six espèces appartenant vraiment au genre *Melanoleuca* -soit *Melanoleuca alboflavida* (Peck) Murrill, *M. melaleuca* (Pers.) Pat. var. *caespitosa* Murrill, *M. planiceps* (Peck) Singer, *M. praecox* Murrill, *M. subcinereiformis* Murrill et *M. subcinerea* (Peck) Murrill- ainsi que *Melanoleuca earlei* (Murrill) Singer sont étudiées de manière plus approfondie.

SUMMARY

88 species described by Murrill under the generic name of *Melanoleuca* and 43 species described by Peck and transfered into the same genus by Murrill and Singer are briefly examined. Among them six species belonging really to the genus *Melanoleuca* -i.e. *Melanoleuca alboflavida* (Peck) Murrill, *M.melaleuca* (Pers.)Pat.var. *caespitosa* Murrill, *M. planiceps* (Peck) Singer, *M. praecox* Murrill, *M. subcinereiformis* Murrill and *M. subcinerea* (Peck) Murrill as well as *Melanoleuca earlei* (Murrill) Singer are studied more thoroughly.

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* Ce travail entre dans le cadre de la préparation d'une thèse de doctorat à l'Université de Lausanne.

I: INTRODUCTION

Patouillard (1887) mentionnait dans la description de son nouveau genre Melaleuca des caractères essentiellement macroscopiques. Ce nom étant déjà occupé pour désigner un genre de phanérogames, Patouillard (1897) le transforme en Melanoleuca . Par la suite Kühner et Maire (1926) ont mis en évidence l'amyloïdie de la paroi sporique en utilisant le réactif de Melzer (1924). Enfin Métrod (1948) puis Singer (1975) ont permis par leurs observations microscopiques de mieux définir les limites du genre Melanoleuca.

A la lumière de ces derniers travaux et sur la base de ceux de Singer (1942), Hesler (1958), Bigelow & Barr (1962), Ammirati & Ovrebo (1979), Bigelow (1979) et Clémençon (1982), nous avons examiné les espèces types de Murrill décrites sous le nom générique de Melanoleuca et celles de Peck transférées par Murrill et Singer dans ce même genre. Nous avons aussi étudié une espèce décrite par Murrill sous le nom générique de Clitocybe et transférée par Singer dans le genre Melanoleuca.

II: MATERIEL ET METHODES

Les types de Peck que nous avons étudiés sont déposés dans les herbiers du Farlow Herbarium (FH) et du New-York State Museum (NYS) et ceux de Murrill dans les herbiers du New-York Botanical Garden (NY) et de l'Université de Floride (FLAS).

Nous avons examiné chaque type en notant l'éventuelle amyloïdie des verrues de la paroi sporique ainsi que, le cas échéant,l'auréole qu'elles déterminent en bordure de la plage supra-apiculaire lisse et,dans ce cas la possible présence de boucles. Nous avons également indiqué les nouvelles combinaisons relevées de l'Index of Fungi (1920-1980), de Saccardo (1887,1925) et mentionné la littérature existante en indiquant, entre +, l'opinion taxonomique exprimée par les auteurs.

Pour les types appartenant vraiment au genre Melanoleuca, nous avons observé, dessiné et mesuré au moyen d'un microscope Zeiss standard muni d'un tube à dessin:

- les spores (longueur et largeur, y compris l'ornementation amyloïde) dans du liquide de Melzer (1924)
- les basides (longueur sans les stérigmates et largeur) et les cystides (longueur, largeur à mi-longueur, plus grande largeur) dans du rouge congo ammoniacal à 1%

- les hyphes (largeur de la cloison) dans de l'ammoniaque à 12%

Toutes les moyennes sont accompagnées du nombre de mesures effectuées et de leurs écart-types. En outre, nous avons calculé pour les spores, les basides et les cystides le rapport de la longueur à la largeur ainsi que l'écart-type et le coefficient de corrélation, qui exprime la régularité, de ce rapport.

Enfin, nous avons replacé ces espèces,lorque cela était possible,dans les différentes sections du genre *Melanoleuca* telles qu'elles ont été récapitulées par Bon (1978).

III: RESULTATS

1. ESPECES A RETRANCHER DU GENRE *MELANOLEUCA* (OBSERVATIONS PERSONELLES)

Hesler (1958) classe toutes les espèces qu'il a observées dans le genre *Tricholoma* .

1.1. COLLECTIONS DE CHARLES-HORTON PECK DEPOSEES A FH

Agaricus (Tricholoma) flavescens Peck (Bull. Buffalo Soc. Nat. Sci. 1:42, 1873) = *Tricholoma flavescens* (Peck) Saccardo (Syll. Fung. 5:119, 1897) = *Melanoleuca thompsoniana* (Peck) Murrill (North American Flora, published by the New-York Botanical Garden 10:14, 1914)= *Tricholoma thompsonianum* (Murrill) Murrill (Mycologia 6:269, 1914) = *Tricholomopsis flavescens* (Peck) Singer (Lilloa 22:196, 1949); Singer 1942:118; spores lisses, inamyloïdes.

Tricholoma semivestitum Peck (Bull. Torrey Bot. Club 22:485, 1895) = *Melanoleuca semivestita* (Peck) Murrill (North American Flora 10:20, 1914) = *Lentinellus semivestitus* (Peck) Singer (Lloydia 5:130, 1942); spores amyloïdes, laticifères, nombreuses boucles.

1.2. COLLECTIONS DE CHARLES-HORTON PECK DEPOSEES A NYS

Tricholoma acre Peck (Bull. Torrey Bot. Club 24:139, 1897) = *Melanoleuca acris* (Peck) Murrill (North American Flora 10:8, 1914); Hesler 1958:187; spores lisses, inamyloïdes.

Agaricus (Clitocybe) albissimus Peck (Bull.Buffalo Soc. Nat. Sci. 1:45, 1873) = *Melanoleuca albissima* (Peck) Murrill (North American Flora 10:8, 1914) = *Leucopaxillus* albissimus (Peck) Sing. (Schweiz. Z. für Pilzkunde 17:57, 1939), spores amyloïdes, sans plage lisse supra-apiculaire clairement délimitée par une auréole de verrues amyloïdes, nombreuses boucles dans le revêtement piléique.

Tricholoma portentosum centrale Peck (Bull. N.Y. State Mus. 25:673, 1899) = Melanoleuca centralis (Peck) Murrill (North American Flora 10:24, 1914), spores lisses, inamyloïdes.

Agaricus (Tricholoma) chrysenteroides Peck (Ann. Rep. N.Y. State Mus. 24:60, 1872) = Tricholoma chrysenteroides (Peck) Saccardo (Syll. Fung. 5:115, 1887) = Melanoleuca chrysenteroides (Peck) Murrill (North American Flora 10:15, 1914); Singer 1942:112 +Tricholoma sect. Sericella+ ,Hesler 1958:187; spores inamyloïdes.

Tricholoma davisiae Peck (Bull. Torrey Bot. Club 27:611, 1900) = Melanoleuca davisiae (Peck) Murrill (North American Flora 10:14, 1914); Hesler 1958:187, Bigelow & Barr 1962:132 +Tricholoma+ , Bigelow 1979:57 +Tricholoma+ ;spores lisses, inamyloïdes.

Agaricus (Tricholoma) fallax Peck (Bull. Buffalo Soc. Nat. Sci. 1:44, 1873) = Tricholoma fallax (Peck) Saccardo (Syll. Fung. 5:115, 1887) = Melanoleuca naucoria (Peck) Murrill (North American Flora 10:15, 1914)= Tricholoma naucoria (Murrill) Murrill (Mycologia 6:269, 1914) = Lyophyllum fallax (Peck) Kühner et Romagnesi (Flore analytique des champignons supérieurs, Paris, p.162, 1953) = Calocybe fallax (Saccardo) Singer ex Redhead et Singer (Mycotaxon 6:501, 1978); spores inamyloïdes.

Agaricus (Tricholoma) fumidellus Peck (Bull. Buffalo Soc. Nat. Sci. 1:44, 1873) = Tricholoma fumidellum (Peck) Saccardo (Syll. Fung. 5: 128, 1887)= Melanoleuca fumidella (Peck) Murrill (North American Flora 10:11, 1914); Hesler 1958:188; spores lisses, inamyloïdes.

Agaricus (Tricholoma) fumosoluteus Peck (Ann. Rep. N.Y. State Mus. 27:92, 1875) = Tricholoma fumosoluteum (Peck) Saccardo (Syll. Fung. 5:122, 1887) = Melanoleuca fumosolutea (Peck) Murrill (North American Flora 10:13, 1914); Bigelow 1979:59 +Tricholoma+ ; spores lisses, inamyloïdes.

Tricholoma grave Peck (Ann. Rep. N.Y. State Mus. 43:63, 1890) = Melanoleuca gravis (North American Flora 10:19, 1914), spores lisses, inamyloïdes.

Agaricus (Tricholoma) impolitoides Peck (Ann. Rep. N.Y. State Mus. 32:25, 1879) = Melanoleuca impolitoides (Peck) Murrill (North American Flora 10:11, 1914), spores lisses, inamyloïdes.

Tricholoma infantile Peck (Bull. N.Y. State Mus. of Natural History 1(2):5, 1887) = Melanoleuca infantilis

(Peck) Murrill (North American Flora 10:11, 1914), spores lisses, inamyloïdes.

Tricholoma intermedium Peck (Ann. Rep. N.Y. State Mus. 41:60, 1888) = Melanoleuca intermedia (Peck) Murrill (North American Flora 10:22, 1914); Hesler 1958:190, Bigelow 1979:60 +Tricholoma+ ; spores lisses, inamyloïdes.

Agaricus (Tricholoma) laterarius Peck (Bull. Buffalo Soc. Nat. Sci. 1:43, 1873) = Melanoleuca lateraria (Peck) Murrill (North American Flora 10:10, 1914), spores amyloïdes et verruqueuses, sans plage lisse supra-apiculaire clairement délimitée par une auréole de verrues amyloïdes, nombreuses boucles dans le revêtement piléique.

Tricholoma latum Peck (Bull. N.Y. State Mus. 167:31, 1913) = Melanoleuca lata (Peck) Murrill (North American Flora 10:12, 1914) = Clitocybe lata (Peck) Singer (Lloydia 5:104, 1942), spores lisses, inamyloïdes.

Tricholoma maculatescens Peck (Ann. Rep. N.Y.State Mus. 44:150, 1891) = Melanoleuca maculatescens (Peck) Murrill (North American Flora 10:17, 1914), spores lisses, inamyloïdes.

Tricholoma niveipes Peck (Bull. Torrey Bot. Club 29:69, 1902) = Melanoleuca niveipes (Peck) Murrill (North American Flora 10:18, 1914);Singer 1942:115;spores lisses, inamyloïdes .

Tricholoma odorum Peck (Bull. Torrey Bot. Club 25:321, 1898) = Melanoleuca odora (Peck) Murrill (North American Flora 10:14, 1914);Singer 1942:113 +Tricholoma sect. Sericella+ , Hesler 1958:191; Ammirati & Ovrebo 1979:361 +Tricholoma+ ; spores lisses, inamyloïdes.

Tricholoma pallidum Peck (Bull.Torrey Bot. Club 24:139, 1897) = Melanoleuca pallida (Peck) Murrill (North American Flora 10:9, 1914), spores lisses, inamyloïdes.

Tricholoma piperatum Peck (Bull. Torrey Bot. Club 26:63, 1899) = Melanoleuca piperata (Peck) Murrill (North American Flora 10:20, 1914), spores lisses, inamyloïdes.

Tricholoma radicatum Peck (Bull. N.Y. State Mus. 67:22, 1903) = Melanoleuca radicata (Peck) Murrill (North American Flora 10:10, 1914) = Tricholomopsis radicata (Peck) Singer (Lloydia 5:118, 1942), spores lisses, inamyloïdes.

Tricholoma rimosum Peck (Bull. N.Y. State Mus. 54:947, 1902) = Melanoleuca rimosa (Peck) Murrill (North American Flora 10:18, 1914), spores lisses, inamyloïdes.

Tricholoma serratifolium Peck (Ann. Rep.N.Y. State Mus. 46:102, 1893) = Melanoleuca serratifolia (Peck) Murrill (North American Flora 10:10, 1914), spores lisses,inamyloïdes.

Tricholoma silvaticum Peck (Ann. Rep. of the Trustees of the State Museum of Natural History 42:113, 1889) = *Melanoleuca silvatica* (Peck) Murrill (North American Flora 10:8, 1914), spores lisses, inamyloïdes.

Agaricus (Tricholoma) striatifolius Peck (Ann. Rep. N.Y. State Mus. 30:37, 1878) = *Tricholoma striatifolium* (Peck) Saccardo (Syll. Fung. 5:119, 1887) = *Melanoleuca striatifolia* (Peck) Murrill (North American Flora 10:11, 1914), spores lisses, inamyloïdes.

Tricholoma subacutum Peck (Ann. Rep. of the Trustees of the State Museum of Natural History 42:112, 1889) = *Melanoleuca subacuta* (Peck) Murrill (North American Flora 10:7, 1914); Singer 1942:116 +proche de *Tricholoma virgatum*+ , Ammirati & Ovrebo 1979:362 +*Tricholoma*+ ;spores lisses, inamyloïdes.

Armillaria subannulata Peck (Bull. Torrey Bot. Club 36:330, 1909) = *Melanoleuca subannulata* (Peck) Murrill (North American Flora 10:30, 1914) = *Tricholoma subannulatum* (Peck) Zeller (Mycologia 14:187, 1922), spores lisses, inamyloïdes.

Tricholoma subluteum Peck (Bull. N.Y. State Mus. 75:21, 1904) = *Melanoleuca sublutea* (Peck) Murrill (North American Flora 10:13, 1914); Hesler 1958:190, Bigelow 1979:60 +*Tricholoma*+ ; spores lisses, inamyloïdes.

Tricholoma submaculatum Peck (Ann. Rep. N.Y. State Mus. 46:102, 1893) = *Melanoleuca submaculta* (Peck) Murrill (North American Flora 10:18, 1914), spores lisses, inamyloïdes.

Tricholoma subsaponaceum Peck (Bull. N.Y. State Mus. 157:35, 1912) = *Melanoleuca subsaponacea* (Peck) Murrill (North American Flora 10:10, 1914), spores lisses, inamyloïdes.

Tricholoma subsejunctum Peck (Bull. N.Y. State Mus. 157:53, 1912) = *Melanoleuca subsejuncta* (Peck) Murrill (North American Flora 10:24, 1914); Singer 1942:115 +*Tricholoma* s.gen. *Eu-Tricholoma*+ ,Hesler 1958:187, Ammirati & Ovrebo 1979:366 +*Tricholoma*+ ,Bigelow 1979:57 +*Tricholoma*+ ; spores lisses, inamyloïdes.

Agaricus (Tricholoma) terraeolens Peck (Ann. Rep. N.Y. State Mus. 38:84, 1885) = *Tricholoma terraeolens* (Peck) Saccardo (Syll. Fung. 5:113, 1887) = *Melanoleuca terraeolens* (Peck) Murrill (North American Flora 10:11, 1914); Singer 1942:99; spores lisses, inamyloïdes.

Tricholoma terriferum Peck (Ann. Rep. N.Y. State Mus. 41:60, 1888) = *Melanoleuca terrifera* (North American Flora 10:22, 1914); Ammirati & Ovrebo 1979:367 +*Tricholoma*+ ;

spores lisses, inamyloïdes.

Agaricus (Tricholoma) thujinus Peck (Bull. Buffalo Soc. Nat. Sci. 1:44, 1873) = *Tricholoma thujina* (Peck) Saccardo (Syll. Fung 5:137, 1887) = *Melanoleuca thujina* (Peck) Murrill (North American Flora 10:16, 1914); Singer 1975:224 +peut-être un *Calocybe+* ; spores lisses, inamyloïdes.

Agaricus (Tricholoma) transmutans Peck (Ann. Rep. N.Y. State Mus. 29:38, 1878) = *Tricholoma transmutans* (Peck) Saccardo (Syll. Fung. 5:91,1887) = *Melanoleuca transmutans* (Peck) Murrill (North American Flora 10:23, 1914); Singer 1942:115 *+Tricholoma* s. gen. *Eu-Tricholoma* ,proche de *T. flavobrunneum+* ,Ammirati & Ovrebo 1979:368 *+Tricholoma+* ; spores lisses, inamyloïdes.

Agaricus (Tricholoma) trentonensis Peck (Ann. Rep. N.Y. State Mus. 24:60, 1872) = *Melanoleuca trentonensis* (Peck) Murrill (North American Flora 10:12, 1914), spores lisses, inamyloïdes.

Tricholoma unifactum Peck (Bull. N.Y. State Mus. 105:36, 1906) = *Melanoleuca unifacta* (Peck) Murrill (North American Flora 10:9, 1914), spores lisses, inamyloïdes.

Agaricus (Tricholoma) virescens Peck (Bull. Buffalo Soc. Nat. Sci. 1:44, 1873) = *Tricholoma viriditinctum* (Peck) Saccardo (Syll. Fung. 5:128, 1887) = *Melanoleuca viriditincta* (Peck) Murrill (North American Flora 10:16, 1914); Hesler 1958:191; spores lisses, inamyloïdes.

Tricholoma viscosum Peck (Bull. Torrey Bot. Club 31:178, 1904) = *Melanoleuca viscosa* (Peck) Murrill (North American Flora 10:23, 1914), spores lisses, inamyloïdes.

1.3. COLLECTIONS DE WILLIAM-ALPHONSO MURRILL DEPOSEES A FLAS

(la lettre F accompagnée d'un numéro qui suit les observations microscopiques désigne la collection type étudiée)

Melanoleuca adusta Murrill (J. Elisha Mitchell Sci. Soc. 55:370, 1939) = *Tricholoma adustum* (Murrill) Murrill (J. Elisha Mitchell Sci. Soc. 55:372, 1939); Hesler 1958:187; spores lisses, inamyloïdes. -F 18401-

Melanoleuca alachuana Murrill (Mycologia 30:365,1938) = *Tricholoma alachuanum* (Murrill) Murrill (Mycologia 30:371, 1938); Hesler 1958:186; spores lisses, inamyloïdes. -F 9856-

Melanoleuca albissima (Peck) Murrill var. *floridana* Murrill (Bull. Torrey Bot. Cl. 67:147, 1940), spores amyloïdes, sans plage lisse supra-apiculaire délimitée par une auréole de verrues amyloïdes, nombreuses boucles dans le revêtement piléique. -F 18287-

Melanoleuca australis Murrill (Lloydia 7:306, 1944) = *Tricholoma australe* (Murrill) Murrill (Lloydia 7:327, 1944); Hesler 1958:187; spores lisses, inamyloïdes. -F 20072-

Melanoleuca calceifolia Murrill (Lloydia 8:275, 1945) = *Tricholoma calceifolium* (Murrill) Murrill (Lloydia 8:290, 1945); Hesler 1958:187; spores lisses, inamyloïdes. -F 19948-

Melanoleuca citrinifolia Murrill (Mycologia 30:365, 1938) = *Tricholoma citrinifolium* (Murrill) Murrill (Mycologia 30:371, 1938); Hesler 1958:190, Bigelow 1979:57 *+Tricholoma+* ; spores lisses, inamyloïdes. -F 9860-

Melanoleuca entoloma Murrill (Lloydia 5:140, 1942) = *Tricholoma entoloma* (Murrill) Murrill (Lloydia 5:157, 1942) = *Clitocybe entoloma* (Murrill) Singer (Sydowia 31:231, 1979); Hesler 1958:190; spores lisses, inamyloïdes. -F 19292- Note : Murrill (Lloydia 12:64, 1949) synonymise *Melanoleuca entoloma* Murrill avec *Melanoleuca subrimosa* Murrill.

Melanoleuca ferruginescens Murrill (Lloydia 7:306, 1944) = *Tricholoma ferruginescens* (Murrill) Murrill (Lloydia 7:327, 1944); Hesler 1958:190; spores lisses, inamyloïdes. -F 21691-

Melanoleuca floridana Murrill (Lloydia 7:306, 1944) = *Tricholoma floridanum* (Murrill) Murrill (Lloydia 7:327, 1944); Hesler 1958:188; spores lisses, inamyloïdes. -F 17965-

Melanoleuca fulvidisca Murrill (Lloydia 7:307, 1944) = *Tricholoma fulvidiscum* (Murrill) Murrill (Lloydia 7:327, 1944); Hesler 1958:188; spores lisses, inamyloïdes. -F 17805-

Melanoleuca hygrophorus Murrill (Lloydia 7:307, 1944) = *Tricholoma hygrophorus* (Murrill) Murrill (Lloydia 7:327, 1944); Hesler 1958:186; spores lisses, inamyloïdes. -F 17914-

Melanoleuca lasciviformis Murrill (Lloydia 8:275, 1945) = *Tricholoma lasciviforme* (Murrill) Murrill (Lloydia 8:290, 1945), spores verruqueuses, inamyloïdes. -F 32726-

Melanoleuca maculata Murrill (Bull. Torrey Bot. Cl. 67:147, 1940) = *Tricholoma maculatum* (Murrill) Murrill (Bull. Torrey Bot.Cl. 67:154, 1940); Hesler 1958:191; spores lisses, inamyloïdes. -F 18275-

Melanoleuca malodora Murrill (Lloydia 5:141, 1942) = *Tricholoma malodorum* (Murrill) Murrill (Lloydia 5:157, 1942), spores inamyloïdes. -F 20102-

Melanoleuca margarita Murrill (Bull. Torrey Bot. Cl. 67:279, 1940) = *Tricholoma margarita* (Murrill) Murrill

(Bull. Torrey Bot. Cl. 67:281, 1940) = *Collybia margarita* (Murrill) Singer (Lilloa 22:201, 1949); Hesler 1958:188; spores lisses, inamyloïdes. -F 18454-

Melanoleuca melaleuciformis Murrill (Lloydia 8:275, 1945) = *Tricholoma melaleuciforme* (Murrill) Murrill (Lloydia 8:290, 1945); Hesler 1958:188; spores lisses, inamyloïdes. -F 17233-

Melanoleuca microsperma Murrill (Lloydia 8:276, 1945)= *Tricholoma microspermum* (Murrill) Murrill (Lloydia 8:290, 1945); Hesler 1958:188; spores lisses, inamyloïdes. -F 18641-

Melanoleuca peralba Murrill (Lloydia 5:141, 1942) = *Tricholoma peralbum* (Murrill) Murrill (Lloydia 5:157, 1942); Hesler 1958:186; spores lisses, inamyloïdes. -F 19271-

Melanoleuca piperatiformis Murrill (Lloydia 9:322,1946) = *Tricholoma piperatifome* (Murrill) Murrill (Lloydia 9:330, 1946); Hesler 1958:189; spores lisses, inamyloïdes. -F 18330-

Melanoleuca platyphylloides Murrill (Lloydia 7:308, 1944) = *Tricholoma platyphylloides* (Murrill) Murrill (Lloydia 7:327, 1944); Hesler 1958:189; spores lisses, inamyloïdes. -F 17915-

Melanoleuca praebulbosa Murrill (Lloydia 5:141, 1942) = *Tricholoma praebulbosum* (Murrill) Murrill (Lloydia 5:157, 1942); Hesler 1958:189; spores lisses, inamyloïdes. -F 19310-

Tricholoma russuloides Murrill (Mycologia 44:113, 1952) = *Melanoleuca russuloides* (Murrill) Murrill (Mycologia 44:113, 1952), spores amyloïdes, sphaerocystes, macrocystides. -F 16268-

Melanoleuca silvaticoides Murrill (Q. Jl. Fla Acad.Sci. 8:177, 1945) = *Tricholoma silvaticoides* (Murrill) Murrill (Q. Jl. Fla Acad. Sci. 8:198, 1945); Hesler 1958:186; spores lisses, inamyloïdes. -F 18508-

Melanoleuca subacris Murrill (Lloydia 5:142, 1942) = *Tricholoma subacre* (Murrill) Murrill (Lloydia 5:157,1942); Hesler 1958:189; spores lisses, inamyloïdes. -F 20097-

Melanoleuca subcylindrispora Murrill (Q. Jl. Fla Acad. Sci. 8:177, 1945) = *Tricholoma subcylindrisporum* (Murrill) Murrill (Q. Jl. Fla Acad. Sci. 8:198, 1945); Hesler 1958:186; spores lisses, inamyloïdes. -F 18649-

Melanoleuca subfulvidisca Murrill (Lloydia 12:67, 1949) = *Tricholoma subfulvidiscum* (Murrill) Murrill (Lloydia 12:67, 1949); Hesler 1958:189; spores lisses, inamyloïdes. -F 40825-

Melanoleuca sublata Murrill (Lloydia 5:142, 1942) =

Tricholoma sublatum (Murrill) Murrill (Lloydia 5:157, 1942) = *Lactaria sublata* (Murrill) Murrill (Mycologia 36:122, 1944) = *Lactarius sublatus* (Murrill) Murrill (Mycologia 39:132, 1947); spores amyloïdes, sans plages lisse supraapiculaire délimitée par une auréole de verrues amyloïdes. -F 19946-

Melanoleuca subsilvatica Murrill (Lloydia 12:67,1949) = *Tricholoma subsilvaticum* (Murrill) Murrill (Lloydia 12:68, 1949); Hesler 1958:190; spores lisses, inamyloïdes. -F 17918-

Melanoleuca subterreiformis Murrill (Proc. Fla Acad. Sci. 7:110, 1944, publié en 1945) = *Tricholoma subterreiforme* (Murrill) Murrill (Proc. Fla Acad. Sci. 7:127, 1944, publié en 1945); Hesler 1958:190; spores lisses, inamyloïdes. -F 19995-

Melanoleuca subvolkertii Murrill (Q. Jl. Fla Acad. Sci. 8:177, 1945) = *Tricholoma subvolkertii* (Murrill) Murrill (Q. Jl. Fla Acad. Sci. 8:198, 1945); Hesler 1958:190; spores lisses, inamyloïdes. -F 32906-

Melanoleuca ustaliformis Murrill (Lloydia 7:307,1944) = *Tricholoma ustaliforme* (Lloydia 7:327, 1944); Hesler 1958:191; spores lisses, inamyloïdes. -F 19488-

Melanoleuca virginea Murrill (Lloydia 5:143, 1942) = *Tricholoma virgineum* (Murrill) Murrill (Lloydia 5:157, 1942); Hesler 1958:191; spores lisses, inamyloïdes. -F 20101-

Melanoleuca watsonii Murrill (Proc. Fla. Acad. Sci. 7:111, 1944, publié en 1945) = *Tricholoma watsonii* (Murrill) Murrill (Proc. Fla. Acad. Sci. 7:127, 1944, publié en 1945); Hesler 1958:191; spores lisses, inamyloïdes. -F 21512-

Melanoleuca westiana Murrill (Bull. Torrey Bot. Cl. 67:147, 1940) = *Tricholoma westiana* (Murrill) Murrill (Bull. Torrey Bot. Cl. 67:154, 1940) = *Collybia westii* (Murrill) Singer (Lilloa 22:201, 1949); Hesler 1958:190; spores lisses, inamyloïdes. -F 17849-

1.4. COLLECTIONS DE WILLIAM-ALPHONSO MURRILL DEPOSEES A NY

(le nom du collecteur, accompagné ou non d'un numéro, qui suit les observations microscopiques désigne la collection type étudiée).

Melanoleuca alabamensis Murrill (North American Flora 10:16, 1914) = *Tricholoma alabamense* (Murrill) Murrill (Mycologia 6:269, 1914); Hesler 1958:190; spores lisses, inamyloïdes. -F.S. Earle-

Melanoleuca angustifolia Murrill (North American Flora

10:22, 1914) = Tricholoma angustifolium (Murrill) Murrill (Mycologia 6:269, 1914) ;Singer 1942:114 +Tricholoma s. gen. Eu-Tricholoma ,proche de T.equestre +;Bigelow 1979:61 +Tricholoma+ ; spores lisses, inamyloïdes.-W.A. Murrill-

Melanoleuca anomala Murrill (Mycologia 5:214, 1913) = Tricholoma anomalum (Murrill) Murrill (Mycologia 5:223, 1913), spores lisses, inamyloïdes. -W.A. Murrill & L.R. Abrams 1198-

Melanoleuca arenicola Murrill (Mycologia 5:214, 1913) = Tricholoma arenicola (Murrill) Murrill (Mycologia 5:223, 1913); Singer 1942:115 +Tricholoma s.gen. Eu-Tricholoma, proche de T. imbricatum et de T. albobrunneum+ ;spores lisses, inamyloïdes.-W.A. Murrill 1035-

Melanoleuca aromatica Murrill (North American Flora 10:15, 1914) = Tricholoma aromaticum (Murrill) Murrill (Mycologia 6:269, 1914) = Clitocybe aromatica (Murrill) Bigelow (Lloydia 28:161, 1965) = Calocybe aromatica (Murrill) Harmaja (Karstenia 15:16, 1976), spores lisses, inamyloïdes. -C.H. Kauffman-

Melanoleuca avellanea Murrill (Mycologia 5:215, 1913) = Tricholoma avellaneum (Murrill) Murrill (Mycologia 5:223, 1913) = Clitocybe avellanea (Murrill) Singer (Lloydia 5:104, 1942), spores lisses, inamyloïdes. -W.A. Murrill 274- (Collection identique au type -W.A. Murrill 267-).

Melanoleuca avellaneifolia Murrill (Mycologia 5:215, 1913) = Tricholoma avellaneifolium (Murrill) Murrill (Mycologia 5:223, 1913), spores lisses, inamyloïdes. -W.A. Murrill 841-

Melanoleuca bicolor Murrill (Mycologia 5:215, 1913) = Tricholoma bicolor (Murrill) Murrill (Mycologia 5:223, 1913);Singer 1975:294 +Leucopaxillus sect. Leucopaxillus+ , spores amyloïdes, sans plage lisse délimitée par une auréole de verrues amyloïdes, nombreuses boucles dans le revêtement piléique. -W.A. Murrill 745-

Melanoleuca californica Murrill (Mycologia 5:216, 1913) = Tricholoma californicum (Murrill) Murrill (Mycologia 5:223, 1913); Singer 1942:114 +Tricholoma s.gen. Eu-Tricholoma ,proche de T. ustale+ ; spores lisses,inamyloïdes. -James Mc Murphy 125-

Melanoleuca collybiiformis Murrill (Mycologia 5:216, 1913) = Tricholoma collybiiforme (Murrill) Murrill (Mycologia 5:223, 1913) = Collybia collybiiformis (Murrill) Singer (Lloydia 5:124, 1942) ;spores lisses, inamyloïdes.-W.A. Murrill 322-

Melanoleuca compressipes Murrill (North American Flora 10:19, 1914) = Tricholoma compressipes (Murrill) Murrill

(Mycologia 6:269, 1914) = Hesler 1958:187; spores lisses, inamyloïdes. -F.S. Earle-

Melanoleuca dryophila Murrill (Mycologia 5:217, 1913) = *Tricholoma dryophilum* (Murrill) Murrill (Mycologia 5:223, 1913); Singer 1942:114 *+Tricholoma* s.gen. *Eu-Tricholoma,* proche de *T. resplendens+* ; spores lisses, inamyloïdes. -James Mc Murphy 27-

Melanoleuca earleae Murrill (North American Flora 10:18, 1914) = *Tricholoma earleae* (Murrill) Murrill (Mycologia 6:269, 1914); Singer 1942:114 *+Tricholoma+* , Hesler 1958:187; spores lisses, inamyloïdes. -F.S. Earle-

Melanoleuca eduriformis Murrill (North American Flora 10:18, 1914) = *Tricholoma eduriforme* (Murrill) Murrill (Mycologia 6:269, 1914) ; Singer 1942:125 +probablement *Collybia+* ; spores lisses, inamyloïdes.-W.A. Murrill-

Melanoleuca farinacea Murrill (Mycologia 5:217, 1913) = *Tricholoma farinaceum* (Murrill) Murrill (Mycologia 5:223, 1913); Singer 1942:112 +appartient au même groupe que *Tricholoma mongolicum+* ; spores lisses, inamyloïdes. -W.A. Murrill 644

Melanoleuca fumosella Murrill (North American Flora 10:28, 1914) = *Tricholoma fumosellum* (Murrill) Murrill (Mycologia 6:269, 1914) ; Singer 1942:116 +identique à *Tricholoma dryophilum+* ;spores lisses, inamyloïdes.-C.F. Baker 5078-

Melanoleuca harperi Murrill (Mycologia 5:217, 1913) = *Tricholoma harperi* (Murrill) Murrill (Mycologia 5:223, 1913) = *Lepista harperi* (Murrill) Singer (Lilloa 22:192, 1949); Singer 1942:108 *+Rhodopaxillus* , fait partie du groupe de *R. nimbatus+* ;spores lisses, inamyloïdes. -R.A. Harper 12-

Melanoleuca jalapensis Murrill (Mycologia 3:194,1911) = *Tricholoma jalapensis* (Murrill) Murrill (Mycologia 4:332, 1912) , spores inamyloïdes, pluriangulaires; métuloides. -W.A. & Edna L. Murrill 85-

Melanoleuca jamaicensis Murrill (Mycologia 3:194, 1911) = *Tricholoma jamaicensis* (Murrill) Murrill (Mycologia 4:332, 1912), spores lisses, inamyloïdes. -W.A. & Edna L. Murrill 720-

Melanoleuca kauffmanii Murrill (North American Flora 10:9, 1914) = *Tricholoma kauffmanii* (Murrill) Murrill (Mycologia 6:269, 1914) , spores lisses, inamyloïdes.-C.H. Kauffman-

Melanoleuca longipes Murrill (North American Flora 10:16, 1914) = *Tricholoma longipes* (Murrill) Murrill (Mycologia 6:269, 1914) , spores inamyloïdes. -W.A. & Edna L. Murrill 1161-

Melanoleuca memmingeri Murrill (North American Flora 10:13, 1914) = Tricholoma memmingeri (Murrill) Murrill (Mycologia 6:269, 1914); Singer 1942:125 +peut-être Collybia+ ,Hesler 1958:188; spores lisses, inamyloïdes. -E.R. Memminger-

Melanoleuca nuciolens Murrill (Mycologia 5:218, 1913) = Tricholoma nuciolens (Murrill) Murrill (Mycologia 5:223, 1913) = Rhodocybe nuciolens (Murrill) Singer (Mycologia 38:687, 1946); Singer 1942:110 +très proche de Rhodopaxillus nitellinus et de R. truncatus +; spores lisses, inamyloïdes. -W.A. Murrill 658-

Melanoleuca odorifera Murrill (North American Flora 10:15, 1914) = Tricholoma odoriferum (Murrill) Murrill (Mycologia 6:269, 1914) , spores lisses, inamyloïdes.-F.S. Earle 1234-

Melanoleuca olesonii Murrill (Mycologia 5:218, 1913) = Tricholoma olesonii (Murrill) Murrill (Mycologia 5:223, 1913); Singer 1942:110; spores lisses, inamyloïdes. -O.M. Oleson 100-

Melanoleuca oreades Murrill (Mycologia 5:218, 1913) = Tricholoma oreades (Murrill) Murrill (Mycologia 5:223, 1913); Singer 1975:293 +Leucopaxillus sect. Aspropaxilli+ , spores amyloïdes, sans plage lisse délimitée par une auréole de verrues amyloïdes. -W.A. Murrill 732-

Melanoleuca pinicola Murrill (Mycologia 5:219, 1913) = Tricholoma pinicola (Murrill) Murrill (Mycologia 5:223, 1913) = Collybia pinicola (Murrill) Singer (Lloydia 5:124, 1942); spores lisses, inamyloïdes. -W.A. Murrill 730-

Melanoleuca platyphylla Murrill (Mycologia 5:219,1913) = Tricholoma platyphyllum (Murrill) Murrill (Mycologia 5:223, 1913);Singer 1942:113 +Tricholoma sect. Sericella+ ; spores lisses, inamyloïdes. -W.A. Murrill 419-

Melanoleuca portolensis Murrill (Mycologia 5:219, 1913) = Tricholoma portolense (Murrill) Murrill (Mycologia 5:223, 1913); Singer 1942:121 +position taxonomique incertaine+; spores lisses, inamyloïdes.-James Mc Murphy 23-

Melanoleuca praemagna Murrill (North American Flora 10:12, 1914) = Tricholoma praemagnum (Murrill) Murrill (Mycologia 6:269, 1914) = Lepista praemagna (Murrill) Singer (Lilloa 22:192, 1949) = Clitocybe praemagna (Murrill) Bigelow & Smith (Brittonia 21:164, 1969); Singer 1942:109 +Rhodopaxillus+ ;spores inamyloïdes.-E. Bartholomew 2611 1/2-

Melanoleuca pulverulentipes Murrill (Mycologia 9:179, 1917) = Tricholoma pulverulentipes (Murrill) Saccardo et Trotter (Syll. Fung. 23:46, 1925), spores lisses, inamyloïdes.-W.A. & Edna L. Murrill 181-

Melanoleuca robinsoniae Murrill (North American Flora 10:10, 1914) = Tricholoma robinsoniae (Murrill) Murrill (Mycologia 6:269, 1914) = Clitocybe celata (Murrill) Bigelow (Mycologia 73:138, 1981), spores lisses, inamyloïdes. -W. J. Robinson 12-

Melanoleuca roseibrunnea Murrill (Mycologia 5:220, 1913) = Tricholoma roseibrunneum (Murrill) Murrill (Mycologia 5:223, 1913); Singer 1975:294 +Leucopaxillus sect. Leucopaxillus+ , spores amyloïdes sans plages lisse supra-apiculaire clairement délimitée par une auréole de verrues amyloïdes, nombreuses boucles dans le revêtement piléique. -W.A. Murrill 375-

Melanoleuca rudericola Murrill (Mycologia 5:220, 1913) = Tricholoma rudericola (Murrill) Murrill (Mycologia 5:223, 1913); Singer 1942:108 +proche de Rhodopaxillus+ Singer 1975:247 +Lepista harperi+ ; spores inamyloïdes. James Mc Murphy 18-

Melanoleuca secedifolia Murrill (Mycologia 5:221, 1913) = Tricholoma secedifolium (Murrill) Murrill (Mycologia 5:223, 1913) = Tricholomopsis secedifolia (Murrill) Singer (Lilloa 22:196, 1949); Singer 1942:118; spores lisses, inamyloïdes. -Morton E. Peck 34-

Melanoleuca striatella Murrill (Mycologia 5:221, 1913) = Tricholoma striatellum (Murrill) Murrill (Mycologia 5:223, 1913); Singer 1942:117 +Tricholoma+ ;spores lisses, inamyloïdes. -James Mc Murphy 29-

Melanoleuca subacida Murrill (North American Flora 10:9, 1914) = Tricholoma subacidum (Murrill) Murrill (Mycologia 6:269, 1914); Hesler 1958:191; spores lisses, inamyloïdes. -F.S. Earle-

Melanoleuca subargillacea Murrill (North American Flora 10:19, 1914) = Tricholoma subargillaceum (Murrill) Murrill (Mycologia 6:269, 1914); Singer 1942:111,Hesler 1958:189; spores lisses, inamyloïdes. -F. S. Earle-

Melanoleuca subfuliginea Murrill (North American Flora 10:21, 1914) = Tricholoma subfuligineum (Murrill) Murrill (Mycologia 6:269, 1914) ;Singer 1942:107; spores lisses, inamyloïdes. -W. G. Thompson & W.A. Murrill-

Melanoleuca sublurida Murrill (Mycologia 5:221, 1913) = Tricholoma subluridum (Murrill) Murrill (Mycologia 5:223, 1913); Singer 1942:111 +espèce identique à Melanoleuca subargillacea , M.volkertii , M.tottenii+ ;spores lisses, inamyloïdes. -W.A. Murrill 751-

Melanoleuca submulticeps Murrill (Mycologia 5:221, 1913) = Tricholoma submulticeps (Murrill) Murrill (Mycologia 5:223, 1913); Singer 1942:119 +Lyophyllum du groupe Aggregatum+ ; spores lisses, inamyloïdes. -W.A.

Murrill 659-

Melanoleuca subpessundata Murrill (Mycologia 5:222, 1913) = *Tricholoma subpessundatum* (Murrill) Murrill (Mycologia 5:223, 1913) = *Limacella subpessundata* (Murrill) Singer (Lloydia 5:132, 1942), spores inamyloïdes. -W.A. Murrill 733-

Melanoleuca subresplendens Murrill (North American Flora 10:21, 1914) = *Tricholoma subresplendens* (Murrill) Murrill (Mycologia 6:269, 1914), spores lisses, inamyloïdes. -R.A. Harper-

Melanoleuca subterrea Murrill (North American Flora 10:24, 1914) = *Tricholoma subterreum* (Murrill) Murrill (Mycologia 6:269, 1914); Hesler 1958:187; spores lisses, inamyloïdes. -F.S. Earle-

Melanoleuca subtransmutans Murrill (North American Flora 10:22, 1914) = *Tricholoma subtransmutans* (Murrill) Murrill (Mycologia 6:269, 1914); Singer 1942:116 *+Tricholoma* s.gen. *Eu-Tricholoma+* , Hesler 1958:187; spores lisses, inamyloïdes. -F.S. Earle-

Melanoleuca subvelata Murrill (Mycologia 5:222, 1913) = *Tricholoma subvelatum* (Murrill) Murrill (Mycologia 5:223, 1913); Singer 1942:132 +pas de différence spécifique avec *Limacella subpessundata* (Murrill) Singer+; Singer 1975:431- *+Limacella+* ;spores lisses, inamyloïdes. -W.A. Murrill 567-

Melanoleuca tenuipes Murrill (Mycologia 5:223, 1913) = *Tricholoma tenuipes* (Murrill) Murrill (Mycologia 5:223, 1913), spores lisses, inamyloïdes. -W.A. Murrill 536-

Melanoleuca tottenii Murrill (North American Flora 10:21, 1914) = *Tricholoma tottenii* (Murrill) Murrill (Mycologia 6:269, 1914); Singer 1942:111, Hesler 1958:190; spores lisses,inamyloïdes.-W. C Coker & H. R. Totten 1008-

Melanoleuca unakensis Murrill (North American Flora 10:14, 1914) = *Tricholoma unakense* (Murrill) Murrill (Mycologia 6:269, 1914), Singer 1942:124, Hesler 1958:191; spores lisses,inamyloïdes.-E.D. Clark- (collection identique au type- W.A. Murrill 965-)

Melanoleuca volkertii Murrill (North American Flora 10:20, 1914) = *Tricholoma volkertii* (Murrill) Murrill (Mycologia 6:269, 1914) ; Singer 1942:111; spores lisses, inamyloïdes. -W.A. Murrill & E.C. Volkert-

Melanoleuca yatesii Murrill (North American Flora 10:29, 1914) = *Tricholoma yatesii* (Murrill) Murrill (Mycologia 6:269, 1914) ; Singer 1942:114 *+Tricholoma* s.gen. *Eu-Tricholoma* , proche de *T.equestre* et de *T. sejunctum* , Bigelow 1979:56 +Tricholoma+; spores lisses, inamyloïdes. H.S.Yates 8-

2. ESPECES RETRANCHEES DU GENRE MELANOLEUCA SANS OBSERVATIONS PERSONELLES.

Lyophyllum fuligineum (Peck) Singer (Lloydia 5:119, 1942) = Tricholoma fuligineum Peck (Ann. Rep. N.Y. State Mus. 41:60, 1888) = Melanoleuca fuliginea (Peck) Murrill (North American Flora 10:19, 1914).

Lyophyllum fumescens (Peck) Clémençon (Mycotaxon 15:75, 1982) = Agaricus (Tricholoma) fumescens Peck (Ann. Rep. N.Y. State Mus. 31:32, 1879) = Tricholoma fumescens (Peck) Saccardo (Syll. Fung. 5:119, 1887) = Melanoleuca fumescens (Peck) Murrill (North American Flora 10:12, 1914).

Tricholoma leucocephaloides Peck (Ann. Rep. N.Y. State Mus. 49:30, 1897) = Melanoleuca leucocephaloides (Peck) Murrill (North American Flora 10:9, 1914); Clémençon 1982:94 +cette espèce n'est pas un Lyophyllum+.

Lyophyllum lugubre (Peck) Clémençon (Mycotaxon 15:81, 1982) = Tricholoma lugubre Peck (Ann. Rep. N.Y. State Mus. 49:30, 1897) = Melanoleuca lugubris (Peck) Murrill (North American Flora 10:18, 1914).

Tricholoma tricolor Peck (Ann. Rep. N.Y. State Mus. 41:60, 1888) = Melanoleuca tricolor (Peck) Murrill (North American Flora 10:17, 1914) = Leucopaxillus tricolor (Peck) Kühner (Le Botaniste 17:135, 1926) = Clitocybe tricolor (Peck) Pilàt (Agaricalium Europaeorum Clavis dichotomica, 1951, p.127 ,Prague).

3. ESPECES NON OBSERVEES

Agaricus (Tricholoma) hebeloma Peck (Bull. Buffalo Soc. Nat. Sci. 1:45, 1873) = Tricholoma hebeloma (Peck) Saccardo (Syll. Fung. 5:138, 1887) = Melanoleuca inocybiformis (Peck) Murrill (North American Flora 10:19, 1914) = Tricholoma inocybiforme (Murrill) Murrill (Mycologia 6:269, 1914).

Melanoleuca olivaceiflava Murrill (Mycologia 8:113, 1916) = Tricholoma olivaceoflavum (Murrill) Saccardo et Trotter (Syll. Fung. 23:44, 1925). -non envoyé par NY--

Melanoleuca sordida Murrill (Mycologia 6:3, 1914) .

Melanoleuca subisabellina Murrill (Mycologia 3:194, 1911) = Tricholoma subisabellina (Murrill) Murrill (Mycologia 4:332, 1912). --non envoyé par NY, probablement perdu.--

4. ESPECES APPARTENANT AU GENRE *MELANOLEUCA*

Melanoleuca alboflavida (Peck) Murrill (North American Flora 10:6, 1914) = *Agaricus alboflavidus* Peck (Ann. Rep. N.Y. State Cab. 23:75,1872) = *Tricholoma alboflavidum* (Peck) Saccardo (Syll. Fung. 5:129, 1887). Cette espèce est le type de la section *Alboflavidae* Singer (Cavanillesia 7:123, 1935).-LECTOTYPE PROPOSE ET DEPOSE A NYS-

Spores elliptiques, verruqueuses, présentant une plage supra-apiculaire lisse, souvent mal délimitée et peu distincte. Verrues sphériques, petites, peu marquées, faiblement amyloïdes (0,2-0,9 µ.) (Fig.1,A). Basides claviformes tétrasporiques(Fig.1,B).Pleurocystides fusiformes régulières à apex très souvent aigu, parfois obtus,muni de nombreux cristaux.(Fig.1,C).Cheilocystides fusiformes, régulières, à apex aigu et couvert de cristaux (Fig.1,D).Trame lamellaire à médiostrate filamenteux subrégulier,inamyloïde, hyalin dans le KOH. Revêtement du stipe formé d'hyphes parallèles , de cellules basidiomorphes au sommet du stipe et de caulocystides fusiformes à segment terminal étroit (Fig.1,E). Revêtement piléique formé d'hyphes enchevêtrées et comportant de nombreuses hyphes terminales.

Littérature: Gillman & Miller (1977) : Mycologia 69:944
Singer (1943) : Mycologia 35:155

MESURES

			CYSTIDES				HYPHES		
	SPORES	BASIDES	Pleuro	Cheilo	Caulo	Piléo	T.L.	Cuticule	Stipe
Nombre de mesures	30	10	8	8	8		8	10	18
longueur (1)	8.2	34.6	53.9	53.6	62.9		4.9	3.5	5.9
s(1)	0.8	2.9	6.2	8.4	8.7		0.9	0.5	1.2
Largeur (L)	5.1	7.7	12.4	9.2	8.1				
s(L)	0.4	0.8	2.6	2.3	2.7				
plus grande Largeur(LL)			13.1	10.8	11.5				
s(LL)			2.4	2.2	1.5				
1/L	1.6	4.5	4.5	6.2	8.2				
s(1/L)	0.1	0.4	1.1	1.9	2.2				
R(1/L)	0.57	0.67	0.26	-0.19	0.62				
1/LL			4.2	5.1	5.5				
s(1/LL)			0.8	1.3	0.7				
R(1/LL)			0.41	-0.16	0.5				

T.L.= Trame lamellaire, s= écart-type, R= coefficient de corrélation

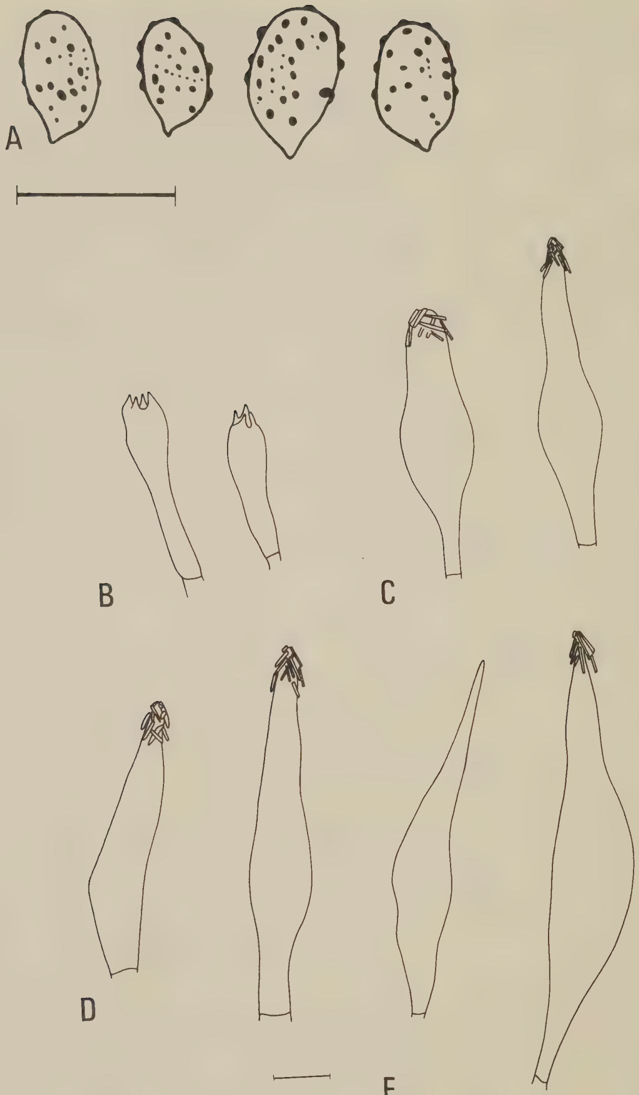

Fig. 1. Melanoleuca alboflavida (Peck) Murrill
A. spores, B. basides, C. pleurocystides, D. cheilocystides, E. caulocystides. Echelle: le trait = 10 µ.

Melanoleuca earlei (Murrill) Singer (Lloydia 5:121, 1942)
= *Clitocybe earlei* Murrill (Mycologia 7:261, 1915).
-LECTOTYPE PROPOSE ET DEPOSE A NY-. -F.S. Earle 1753-

Spores étroitement elliptiques, montrant une plage supra-apiculaire lisse peu distincte, verrues petites, très peu marquées et finement amyloïdes avec une nette tendance à la réunion (0.3-1.1 µ.) (Fig.2,A). Basides claviformes, tétrasporiques (Fig.2,B). Pleurocystides fusiformes, parfois côniques, massives et comportant un apex souvent obtus (Fig.2,C). Cheilocystides semblables aux pleurocystides mais généralement fusiformes.(Fig.2,D). Trame lamellaire à médiostrate filamenteux, subrégulier, hyalin dans le KOH, inamyloïde. Revêtement du stipe formé d'hyphes parallèles à pigment vacuolaire (l'observation de ce caractère est réduite par le mauvais état de conservation des stipes du lectotype et des syntypes). Revêtement piléique formé d'hyphes enchevêtrées-emmêléees à pigment vacuolaire.

MESURES

	SPORES	BASIDES	Pleuro	Cheilo	Caulo	Piléo	HYPHES		
			CYSTIDES				T.L.	Cuticule	Stipe
Nombre de mesures	30	10	8	8			8	8	10
longueur (l)	8.8	43.8	54.0	61.1			6.0	5.0	6.2
s(l)	0.7	4.8	9.4	14.4			1.2	1.3	1.6
Largeur (L)	4.8	5.2	11.8	14.0					
s(L)	0.4	1.6	3.0	3.4					
plus grande Largeur(LL)			13.1	15.6					
s(LL)			2.5	2.9					
l/L	1.8	9.7	4.7	4.5					
s(l/L)	0.2	4.9	0.9	1.2					
R(l/L)	0.46	-0.35	0.75	0.36					
l/LL			4.2	3.9					
s(l/LL)			0.7	0.7					
R(l/LL)			0.68	0.61					

T.L.= Trame lamellaire, s= écart-type, R= coefficient de corrélation

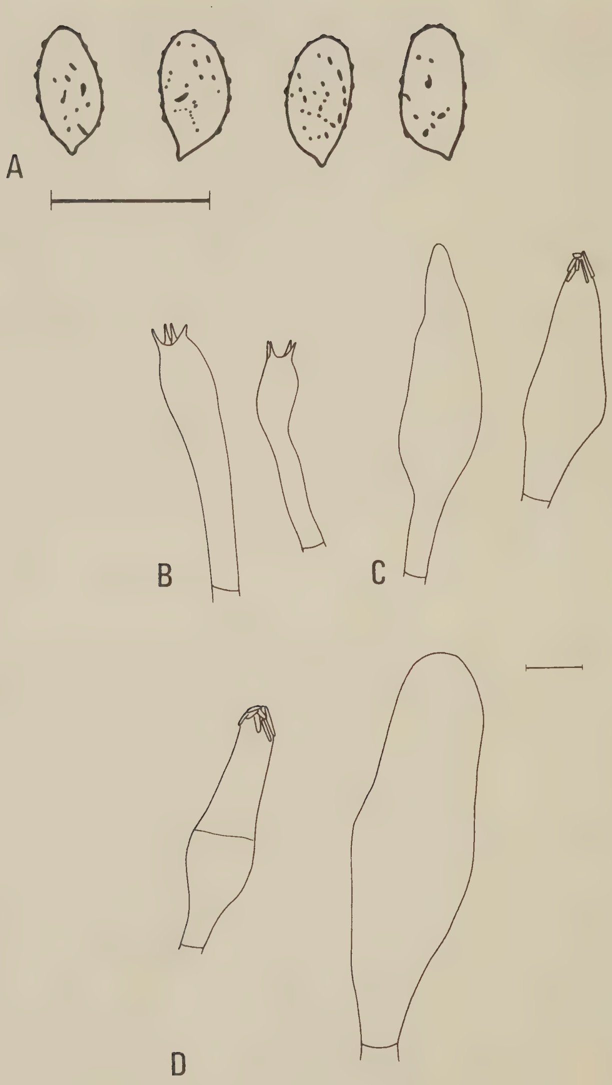

Fig. 2. Melanoleuca Earlei (Murrill) Singer
A. spores, B. basides, C. pleurocystides,
D. cheilocystides. Echelle: le trait = 10 µ.

Melanoleuca melaleuca (Pers.) Pat. var *caespitosa* Murrill (Lloydia 12:67, 1949) = *Tricholoma melaleucum* var. *caespitosum* (Murrill) Murrill (Lloydia 12:67, 1949) LECTOTYPE PROPOSE ET DEPOSE A FLAS-. -F 19927-

Spores elliptiques possédant une plage supra-apiculaire lisse souvent mal délimitée, verrues sphériques, généralement bien individualisées, fortement amyloïdes (0.6-1.3 µ.) (Fig.3,A). Basides tétrasporiques, claviformes (Fig.3,B). Pleurocystides en poils d'ortie, petites, étroites, avec de nombreux cristaux à l'apex (Fig.3,C).Cheilocystides identiques aux pleurocystides. Trame lamellaire à médiostrate filamenteux, subrégulier, hyalin dans le KOH, inamyloïde. Revêtement du stipe formé d'hyphes parallèles à pigment vacuolaire et de caulocystides étroites, en poils d'ortie,comprises dans les bouquets d'hyphes basidiomorphes du sommet du stipe. Revêtement piléique comprenant , à la périphérie, des hyphes enchevêtrées qui se redressent au centre du chapeau. Hyphes à pigment vacuolaire.

MESURES

	SPORES	BASIDES	Pleuro	Cheilo	Caulo	Piléo	HYPHES		
			C Y	S T	I D E	S	T.L.	Cuticule	Stipe
Nombre de mesures	30	10	8	8	10		10	19	10
longueur (l)	7.9	28.6	29.1	32.7	30.7		5.2	4.9	5.2
s(l)	0.5	2.0	6.1	4.6	5.1		0.9	1.5	0.8
Largeur (L)	5.3	5.4	2.8	2.9	2.7				
s(L)	0.4	1.0	0.5	1.4	0.5				
plus grande Largeur(LL)			5.8	5.0	3.3				
s(LL)			3.8	1.1	0.6				
l/L	1.5	5.4	10.5	13.6	11.5				
s(l/L)	0.1	1.1	1.5	6.4	2.2				
R(l/L)	0.35	-0.19	0.64	-0.30	0.46				
l/LL			7.8	6.9	9.6				
s(l/LL)			1.8	1.8	1.8				
R(l/LL)			0.26	0.25	0.42				

T.L.= Trame lamellaire, s= écart-type, R= coefficient de corrélation

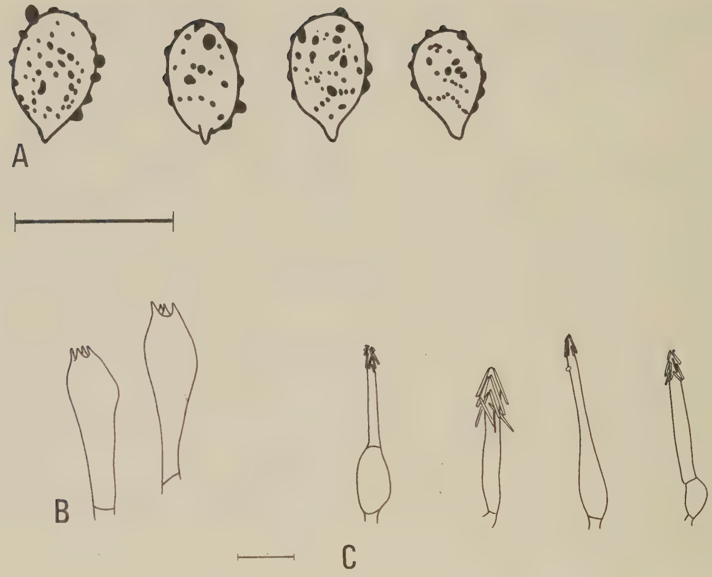

Fig. 3. Melanoleuca melaleuca Pat. var. caespitosa Murrill
A. spores, B. basides, C. pleurocystides. Echelle: le trait = 10 µ.

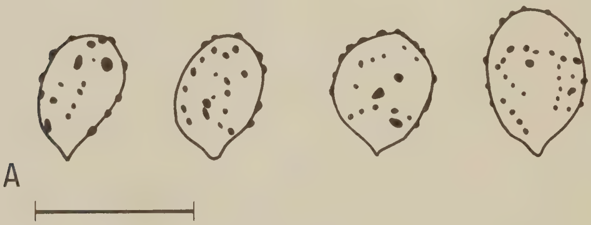

Fig. 4. Melanoleuca planiceps (Peck) Singer
A. spores. Echelle: le trait = 10 µ.

Melanoleuca planiceps (Peck) Singer (Mycologia 35:155, 1943) = Tricholoma planiceps Peck (Bull. N.Y. State Mus. 157:35, 1912). -LECTOTYPE PROPOSE ET DEPOSE A NYS-.

Spores elliptiques à globuleuses, verruqueuses, présentant une plage lisse supra-apiculaire souvent bien délimitée, verrues fortement amyloïdes, sphériques, parfois réticulées (0.5-1.5 µ.)(Fig.4,A). Basides tétrasporiques,claviformes (Fig.4,B). Pleurocystides très rares, petites, montrant parfois un apex obtus, à la limite des poils unicellulaires (Fig.4,C). Cheilocystides: Singer (1942) les décrits en employant l'adjectif "basidiomorphe". Nous n'avons remarqué que des cellules ressemblant très fortement à des basidioles mais présentant un apex légérement plus elliptique (Fig.4,D). Trame lamellaire à médiostrate filamenteux et subrégulier, hyalin dans le KOH, inamyloïde. Revêtement du stipe formé d'hyphe parallèles à pigment vacuolaire, mêlées au sommet du stipe d'hyphes basidiomorphes.Revêtement piléique formé d'hyphes enchevêtrées-emmêlées à pigment vacuolaire.

MESURES

			Pleuro	Cheilo	Caulo	Piléo	HYPHES		
	SPORES	BASIDES	CYSTIDES				T.L.	Cuticule	Stipe
Nombre de mesures	30	10	4	11			10	10	10
longueur (l)	7.4	28.2	21.6	29.4			6.0	4.5	6.1
s(l)	0.5	2.2	4.1	5.8			1.7	1.0	0.9
Largeur (L)	5.4	8.3	3.3	6.8					
s(L)	0.5	1.8	1.1	1.4					
plus grande Largeur(LL)			4.3	9.3					
s(LL)			0.2	0.9					
l/L	1.4	3.5	7.8	4.5					
s(l/L)	0.1	0.6	5.4	1.5					
R(l/L)	0.52	0.05	-0.94	-0.31					
l/LL			5.1	3.2					
s(l/LL)			1.1	0.6					
R(l/LL)			-0.62	0.29					

T.L.= Trame lamellaire, s= écart-type, R= coefficient de corrélation

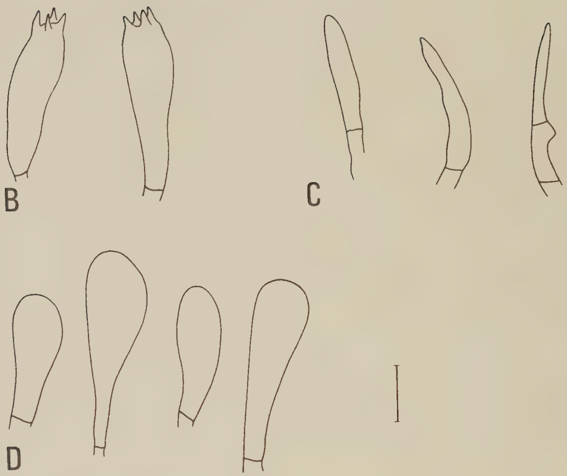

Fig. 4. Melanoleuca planiceps (Peck) Singer
B. basides, C. pleurocystides, D. cheilocystides.
Echelle: le trait = 10 μ.

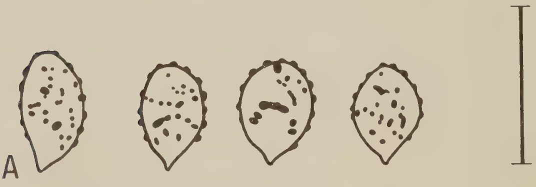

Fig. 5. Melanoleuca praecox Murrill
A. spores. Echelle: le trait = 10 μ.

Melanoleuca praecox Murrill (North American Flora 10:20, 1914) = Tricholoma praecox (Murrill) Murrill (Mycologia 6:269, 1914) -TYPE DEPOSE A NY-. -E.C. Volkert-

Spores elliptiques, verruqueuses, présentant une plage supra-apiculaire lisse, souvent assez mal délimitée, verrues sphériques à rectangulaires fortement amyloïdes (0.4-1.6 µ.) (Fig.5,A). Basides tétrasporiques, claviformes.(Fig.5,B).Pleurocystides rares, en poils d'ortie, montrant un apex étroit (Fig.5,C). Cheilocystides plus fréquentes, également en poils d'ortie comprenant un apex étroit , à la limite des poils marginaux (Fig.5,D). Trame lamellaire à médiostrate filamenteux, subrégulier, hyalin dans le KOH, inamyloïde. Revêtement du stipe formé d'hyphes parallèles contenant un pigment vacuolaire et présentant en son sommet de nombreuses cellules basidiomorphes.Revêtement piléique formé d'hyphes à pigment vacuolaire, enchevêtrées-emmêlées et possédant quelques hyphes terminales se redressant légèrement.

Littérature: Singer (1942) Lloydia 5:121

MESURES

			CYSTIDES				HYPHES		
	SPORES	BASIDES	Pleuro	Cheilo	Caulo	Piléo	T.L.	Cuticule	Stipe
Nombre de mesures	30	10	2	8			12	8	8
longueur (l)	7.7	30.2	30.7	31.5			5.8	4.0	4.2
s(l)	0.6	3.6	25.9	8.3			1.5	0.5	1.3
Largeur (L)	5.3	5.8	1.7	2.1					
s(L)	0.4	0.5	0.4	0.8					
plus grande Largeur(LL)			3.4	4.3					
s(LL)			2.5	1.3					
l/L	1.4	5.2	16.2	17.0					
s(l/L)	0.1	0.6	10.8	5.9					
R(l/L)	0.63	0.30	-	-0.12					
l/LL			8.5	7.9					
s(l/LL)			1.4	2.7					
R(l/LL)			-	0.29					

T.L.= Trame lamellaire, s= écart-type, R= coefficient de corrélation

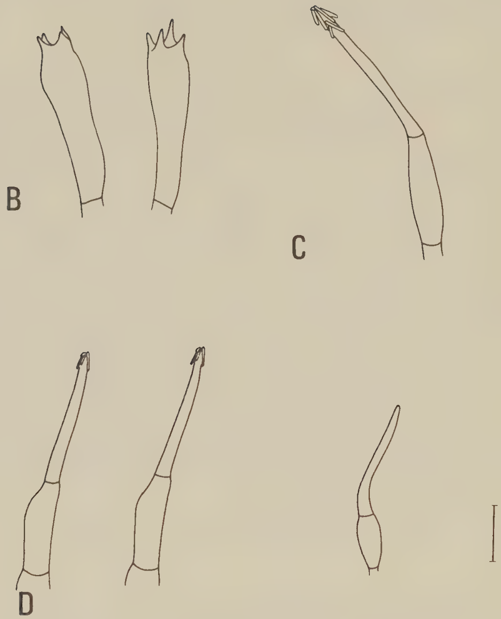

Fig. 5. Melanoleuca praecox Murrill
B. basides, C. pleurocystides, D. cheilocystides.
Echelle: le trait = 10 µ.

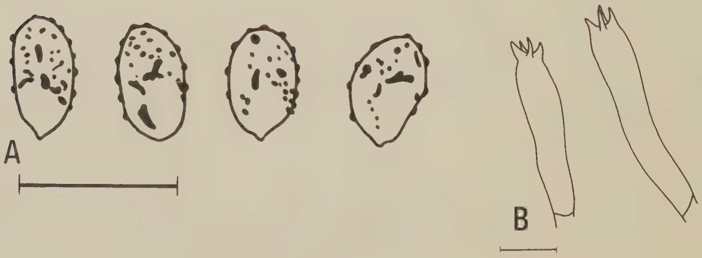

Fig. 6. Melanoleuca subcinereiformis Murrill
A. spores, B. basides. Echelle: le trait = 10 µ.

Melanoleuca subcinereiformis Murrill (North American Flora 10:28, 1914) = *Tricholoma subcinereiforme* (Murrill) Murrill (Mycologia 6:269, 1914) -TYPE DEPOSE A NY-. -W.A. Murrill 901-
Spores étroitement elliptiques présentant une plage supra-apiculaire lisse généralement bien distincte, verrues sphériques, fortement amyloïdes (0.5-1.6 µ.), souvent reliées entre elles par de fins tractus amyloïdes (Fig.6,A). Basides élancées, claviformes, tétrasporiques (Fig.6,B). Pleurocystides fusiformes à sublagéniformes avec parfois un apex obtus mais le plus souvent aigu (Fig.6,C).Cheilocystides fusiformes, élancées, à apex aigu (Fig.6,D). 8 noyaux par cystide.Trame lamellaire à médiostrate filamenteux, subrégulier, hyalin dans le KOH, inamyloïde. Revêtement du stipe formé d'hyphes parallèles à pigment vacuolaire et de cystides fusiformes généralement comprises dans les bouquets d'hyphes basidiomorphes situés au sommet du stipe. Revêtement piléique, légérement gélifié, formé d'hyphes terminales à pigment vacuolaire, comprenant quelques piléocystides fusiformes, émergentes (Fig.6,E).
Littérature: Singer (1942) Lloydia 5:122

MESURES

	SPORES	BASIDES	Pleuro	Cheilo	Caulo	Piléo	H Y P H E S		
			C Y S T I D E S				T.L.	Cuticule	Stipe
Nombre de mesures	30	10	8	8	8	8	12	8	8
longueur (1)	8.0	30.2	61.7	47.9	55.9	51.0	6.2	4.4	5.6
s(1)	0.5	4.4	10.4	18.3	6.1	8.9	1.2	0.9	1.2
Largeur (L)	5.0	6.4	9.0	7.3	6.0	6.2			
s(L)	0.3	0.4	1.8	2.2	1.2	1.8			
plus grande Largeur(LL)			11.1	8.2	7.5	7.3			
s(LL)			1.6	2.0	1.6	1.2			
1/L	1.6	4.7	7.2	6.8	9.5	8.7			
s(1/L)	0.1	0.8	2.1	2.9	1.9	2.1			
R(1/L)	0.56	-0.04	-0.30	0.34	0.008	0.40			
1/LL			5.7	5.9	7.8	7.0			
s(1/LL)			1.5	2.2	1.9	0.8			
R(1/LL)			-0.48	0.51	-0.30	0.70			

T.L.= Trame lamellaire, s= écart-type, R= coefficient de corrélation

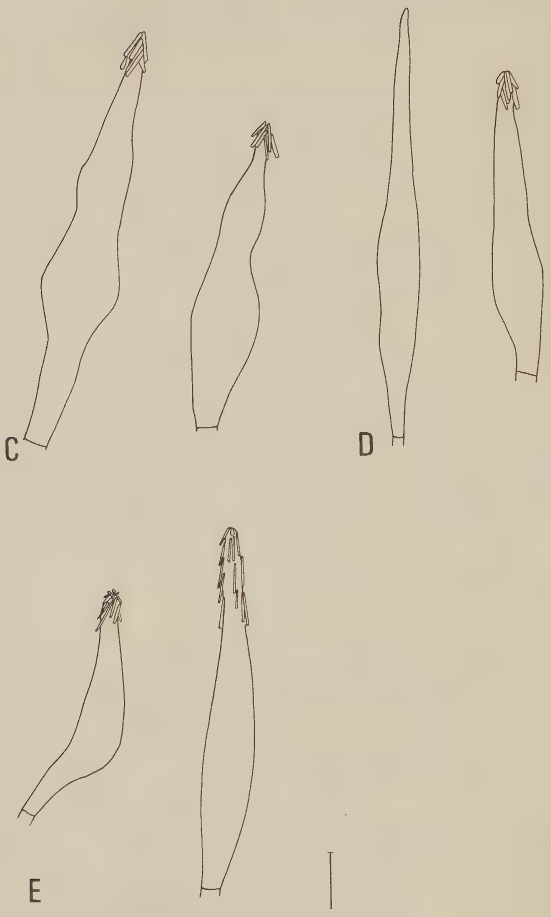

Fig. 6. Melanoleuca subcinereiformis Murrill
C. pleurocystides, D. cheilocystides, E. piléocystides. Echelle: le trait = 10 µ.

Melanoleuca subcinerea (Peck) Murrill (North American Flora 10:7, 1914) = Tricholoma subcinereum Peck (Bull. N.Y. State Mus. 131:27,1909). Cette espèce appartient à la section Grammopodiae Bon (Documents mycologiques 9:45, 1978) -LECTOTYPE PROPOSE ET DEPOSE A NYS-.

Spores elliptiques à subglobuleuses, présentant une plage lisse supra-apiculaire généralement bien délimitée, verrues elliptiques à allongées (0.3-1.1 µ.), fortement amyloïdes (Fig.7,A). Basides claviformes, tétrasporiques (Fig.7,B). Pleurocystides -observées sur un syntype- fréquentes mais isolées en groupe, en poils d'ortie, courtes (Fig.7,C). Cheilocystides en poils d'ortie munies de nombreux cristaux apicaux (Fig.7,D). Trame lamellaire à médiostrate filamenteux, subrégulier, hyalin dans le KOH, inamyloïde. Revêtement du stipe formé d'hyphes parallèles à pigment vacuolaire, comprenant des cystides étroites et filiformes (Fig.7,E) et des cellules basidiomorphes, non réunies. Revêtement piléique formé d'hyphes à pigment vacuolaire, emmélées-enchevêtrées, avec de nombreuses hyphes terminales et des piléocystides étroites, fusiformes, émergentes (Fig.7,F).

MESURES

	SPORES	BASIDES	CYSTIDES				HYPHES		
			Pleuro	Cheilo	Caulo	Piléo	T.L.	Cuticule	Stipe
Nombre de mesures	30	10	7	8	4	8	9	8	8
longueur (l)	8.3	35.5	25.2	34.5	39.3	25.3	5.5	4.1	4.0
s(l)	0.6	4.5	4.8	5.2	4.3	3.5	0.9	0.8	1.0
Largeur (L)	5.7	6.6	3.1	3.4	2.8	2.5			
s(L)	0.4	0.5	1.0	1.2	0.1	0.7			
plus grande Largeur(LL)			3.7	5.0	3.5	3.0			
s(LL)			1.1	1.6	0.5	0.6			
l/L	1.5	5.4	8.5	11.3	13.7	10.8			
s(l/L)	0.1	0.9	2.3	3.9	0.7	3.6			
R(l/L)	0.29	-0.27	0.77	-0.06	0.98	0.02			
l/LL			7.0	7.9	11.2	8.7			
s(l/LL)			1.0	4.2	1.0	1.4			
R(l/LL)			0.92	0.15	0.81	0.56			

T.L.= Trame lamellaire, s= écart-type, R= coefficient de corrélation

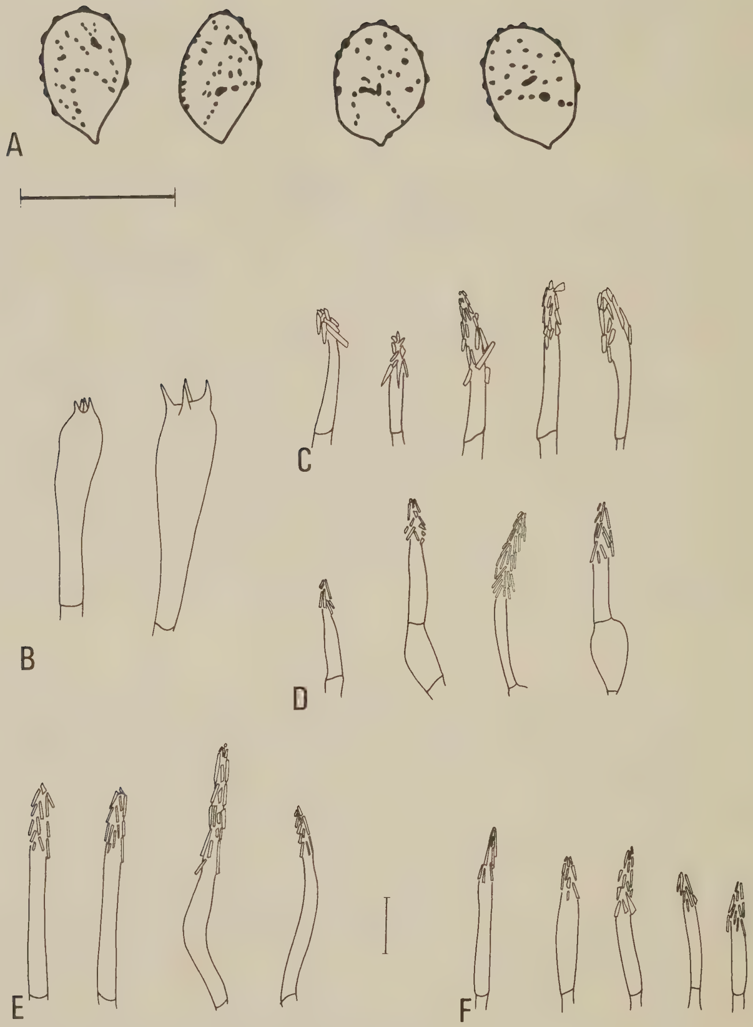

Fig. 7. *Melanoleuca subcinerea* (Peck) Murrill
A. spores, B. basides, C. pleurocystides, D. cheilocystides, E. caulocystides, F. piléocystides.
Echelle: le trait = 10 µ.

IV: CONCLUSIONS

Le rapport du nombre d'espèces examinées appartenant vraiment au genre Melanoleuca au nombre total d'espèces observées avoisine 5.5%. Ce chiffre extrêmement faible est révélateur de l'absence de critères valables conduisant à des diagnostics sûrs (tel par exemple l'amyloïdie de la paroi sporique) dont souffraient les descriptions de Murrill et de Saccardo et du flou intergénérique (principalement Tricholoma-Melanoleuca) qui en a résulté. En revanche, les sept derniers taxa étudiés appartenant tous au genre Melanoleuca semblent bien individualisés. Cependant, seul un examen de tous les types portant le nom générique Melanoleuca selon des critères modernes tels ceux proposés par Singer (1975), Bon (1978), Kühner(1980) et utilisés ici, permettrait de posséder une vue d'ensemble et d'établir synonymies et parentés entre les espèces. C'est ce travail que nous proposons de réaliser ultérieurement.

V: REMERCIEMENTS

Je remercie vivement Monsieur le Professeur Clémençon ainsi que Messieurs Bon, Dr. et Burdet, conservateur qui ont accepté de relire ce travail et qui m'ont communiqué leurs judicieuses remarques. Je remercie également Madame et Messieurs les Drs Patricia K. Holmgren, directeur de l'herbarium de NY, John H. Haines, James W. Kimbrough et Donald H. Pfister, respectivement conservateurs des herbiers de NYS, de FLAS et de FH qui ont bien voulu me prêter les différentes collections étudiées.

VI: REFERENCES BIBLIOGRAPHIQUES

Ammirati, J.-F. & Ovrebo, C.-L. 1979. Types studies: Somes Cortinarius and Tricholoma species described by Charles-Horton Peck. Mycotaxon 8 :353-371.

Bigelow, H.-E. 1979. A contribution to Tricholoma. Beihefte zur Sydowia, Annales Mycologici, ser. II, 8 :54-62.

Bigelow, H.-E. & Barr, M.-E. 1962. Contribution to fungus flora of Northeastern north America II. Rhodora 64 :126-137.

Bon, M. 1978. Tricholomataceae de France et d'Europe occidentale (Leucopaxilloideae). Documents mycologiques 9 :1-79.

Clémençon, H. 1982. Types studies and typification in Lyophyllum (Agaricales). I. Staining species. Mycotaxon 15 :67-94.

Hesler, L.-R. 1958. Southeastern Agaricales II. Journal of the Tennessee Academy of Science 33 :186-191.

Index of Fungi 1920-1980. Commonwealth Mycological Institute, Kew, Surrey.

Kühner, R. 1980. Les Hymenomycètes agaricoides. Numéro spécial du Bulletin de la Société linnéenne de Lyon.

Kühner, R. & Maire, R. 1926. Contribution à l'étude des Hymenomycètes et spécialement des Agaricacées. Le Botaniste 17 :131-139.

Melzer, V. 1924. L'ornementation des spores de Russules. Bulletin de la Société mycologique de France 40:78-81.

Métrod, G. 1948. Essai sur le genre Melanoleuca Patouillard emend. Bulletin de la Société mycologique de France 64 :140-165.

Patouillard, N.-T. 1887. Les Hymenomycètes d'Europe, Paris, Librairie Paul Klincksieck, p.96.

Patouillard, N.-T. 1897. Catalogue raisonné des plantes cellulaires de Tunisie, Paris, Imprimerie Nationale, p.22.

Saccardo, P.-A. 1887, 1925. Sylloge Fungorum 5 :87-141, 23 :25-46

Singer, R. 1942. Types studies on Agarics. Lloydia 5 :97-135.

Singer, R. 1975. The Agaricales in modern taxonomy. Cramer, Vaduz, 912 pages.

MYCOTAXON

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NEW LEAF SPOT FUNGUS, *MARSSONINA BALSAMIFERAE*, ON *POPULUS BALSAMIFERA* IN MANITOBA AND ONTARIO

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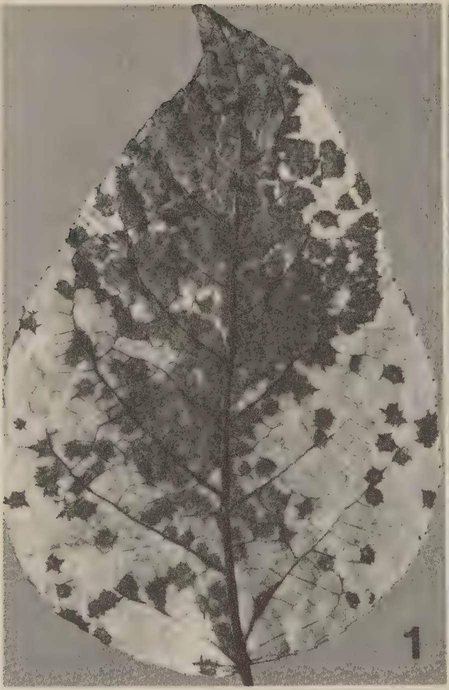
Two herbarium specimens of a fungus associated with leaf spot on *Populus balsamifera* L. collected in Manitoba in 1966, tentatively identified as *Marssonina* sp., were reexamined. They and another specimen collected in or before 1893 in Ontario by J. Dearness deposited in DAOM (Ottawa), are an undescribed species of *Marssonina*. The species is described as follows.

Marssonina balsamiferae Y. Hiratsuka sp. nov.

Acervuli hypophylli, subcutilcularia, in brunneus macula usque ad 5 mm diam et confluentibus. Conidiophorum phialides. Conidia hyalina, parum curvus, uniseptata, cellula apicali magna acutaque, cellula basali cicatrice plana praedita, 18.0-21.0 X 4.5-5.5μ.

Acervuli hypophylous, subcuticular on brown spots up to 5 mm in diameter and often confluent. Conidiophores simple, phialidic. Conidia hyaline, somewhat curved, 2-celled with upper larger cell with pointed end and lower smaller cell with flat basal scar, 18.0-21.0 X 4.5-5.5μ (Figs. 1 and 2).

HOLOTYPE: On *Populus balsamifera* L., CFB (WINF(M)4766), 16 mi N. Riverton, Man., 4 Aug. 1966, J. Arthurs. Isotype at DAOM.
OTHER SPECIMENS EXAMINED: On *Populus balsamifera* L., CFB (WINF(M)4791), 6 mi N. Selkirk, Man., 2 Aug. 1966, J. Arthurs; DAOM (Dearness 331 as *M. populi* (Lib.) Magn.)



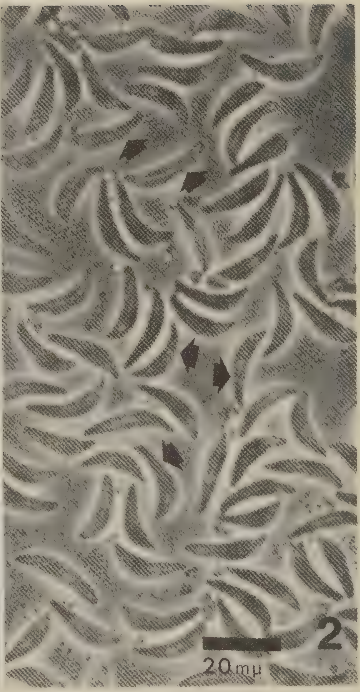


Fig.1. Leaf spot symptom of *Marssonina balsamiferae* Y. Hiratsuka on *Populus balsamifera* L. (CFB(WINF(M) 4791)).

Fig.2. Conidia of *Marssonina balsamiferae* Y. Hiratsuka (CFS(WINF(M) 4791)). Positions of septa are shown in arrows.

London, Ont., in or before 1893, J. Dearness.

Although Sutton (1973) states that *Marssonina*, among several other common and universally known genera of coelomycetes, is heterogenous because of unknown conidium ontogeny in the type species, I think this fungus is best placed in *Marssonina* at this time because the conidia are hyaline, unequally divided into two cells, and produced in acervuli.

Several species of *Marssonia* are known on *Populus: M. populi* (Lib.) Magn., *M. brunnea* (Ell. & Ev.) Magn., *M. castagnei* (Desm. & Mont.) Magn., *M. populina* (Schmabl) Magn., and *M. tremuloides* Kleb. (Rimpau 1962, Gremmen 1965, Pirozynski 1974a, b, c). Distinctions between some of the species and their perfect state relationships (*Drepanopeziza* spp.) are not clear, but none of them has pointed upper cells. *Marssonina fragariae* (Lib.) Kleb. (=*Diplocarpon earlianum* (Ell. & Ev.) Wolf.) on species of *Potentilla* and *Fragaria* has conidia having pointed upper cells (Sutton 1980), but conidia of this species are much larger than those of *M. balsamiferae* (16.5-29.0 X 5.5-8.0μ). A common species of *Marssonina* on *Populus balsamifera* (*M. populi* (Lib.) Magn. = stat. perfect *Drepanopeziza populorum* (Desm.) Höhn.) has conidia of similar size (19.0-23.5 X 6.5-8.0μ) but it differs from *M. balsamiferae* by conidia having rounded rather than pointed upper cells and by occurring mostly on the upper side of leaves rather than on the lower side. Distince brown to reddish brown spots produced by *M. balsamiferae* are very characteristic and are different from all other known leaf spots on balsam poplar.

LITERATURE CITED

Gremmen, J. 1965. Three poplar-inhabiting *Drepanopeziza* species and their life history. Ned. Bosb. Tijdschr. 37:196-198.

Pirozynski, K.A. 1974a. *Marssonina brunnea*. Fungi Canadensis No. 13. National Mycol. Herb. Biosystematic Res. Inst., Agric. Can., Ottawa, 2pp.

Pirozynski, K.A. 1974b. *Marssonina castagnei* Fungi Canadensis No. 14. National Mycol. Herb. Biosystematic Res. Inst., Agric. Can., Ottawa, 2pp.

Pirozynski, K.A. 1974c. *Marssonina populi*. Fungi Canadensis No. 15. National Mycol. Herb. Biosystematic

Res. Inst., Agric. Can., Ottawa, 2pp.

Rimpau, R.G. 1962. Untersuchungen uber der Guttung *Drepanopeziza* (Kleb.) v. Höhn. Phytopathol. Z. 43:257-306.

Sutton, B.C. 1973. Coelomycetes. *In* the fungi, an advanced treatise. Vol. 4A. G.C. Ainsworth, F.K. Sparrow and A.S. Sussman (eds.). Academic Press, New York.

Sutton, B.C. 1980. The Coelomycetes. Commonwealth Mycol. Inst., Kew, Surrey, 696pp.

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TYPE STUDIES IN THE POLYPORACEAE 15, SPECIES DESCRIBED BY L.O. OVERHOLTS, EITHER ALONE OR WITH J.L. LOWE

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SUMMARY

L.O. Overholts, either alone or with J.L. Lowe, described 35 polypores out of which 23 are illegitimately published, 7 are accepted while 5 are synonyms. Of the illegitimately published species, 14 are synonyms while 9 are taxonomically accepted out of which one has previously been validated, while the remaining 8 have been validated with the following names: *Antrodiella americana, A. overholtsii, Antrodia sordida, Perenniporia ellipsospora, P. variegata, P. amylohypha, Spongiporus lateralis* and *Wolfiporia dilatohypha*. The genus *Wolfiporia* is described with *Poria cocos* as type. The following new combinations are proposed: *Antrodia carbonica, Parmastomyces transmutans, Spongiporus subvermisporus* and *Wolfiporia cocos*.

Most of this time as a mycologist, Overholts was occupied with polypores, and the result of his life long studies is found in his famous flora "The Polyporaceae of the United States, Alaska, and Canada" (Overholts, 1953). He did most of his collecting inside the United States, and compared with authors like W. A. Murrill and C. G. Lloyd, he was very careful. He described only 35 species, most of them alone and a few with Professor J. L. Lowe. However, Overholts neglected the International Code of Botanical Nomenclature (in the following abbreviated ICBN), and as he published most of his new species after Jan. 1, 1935 without a Latin description, a very high proportion of his species are described with illegitimate names.

In connection with a new and complete flora of North American polypores (including both resupinate and pileate species), we found it desirable to sort out the problems with Overholts' illegitimate names separately, rather than in the flora itself. Some of Overholts' illegitimately described species have been found to be synonyms, and these species have been left without further treatment to avoid superfluous names. The taxonomically accepted ones have been validated, and we have followed Recommendation 72A in the ICBN and avoided an adoption of the illegitimate epithets and have given them new names.

The species are treated alphabetically according to specific epithet, and when no author is mentioned, they were described by Overholts alone. The status of the name, if illegitimate, is stated together with the type. The types of all species are in the herbarium of the Pennsylvania State University (PAC), and this information has not been repeated for each species. Each type has been given a number in the Overholts herbarium, and if no collector is given, the type was collected by Overholts himself. Overholts published his species in a restricted number of journals, and to save space they are abbreviated as follows: Bull. Penn. Agric. Exp. Sta. = BPA; Bull. Torrey Bot. Club. = BTBC; Mycologia = MYCOL; Proc. Penn. Acad. Sci. = PPA.

Polyporus abieticola MYCOL 33:93. 1941. Illegitimate name, no Latin description. Type: Canada, Quebec, Duchesnay, Aug. 24, 1938. Overholts no. 21571. This specimen represents a collection of *Wrightoporia subrutilans* (Murr.) Ryv., as indicated in Ryvarden (1982:147).

Polyporus aestivale BPA 418:20. 1942. Illegitimate name, no Latin description. Type: USA, Pennsylvania, Clarion County, Cook Forest, June 23, 1932. L. O. Overholts and L. W. White no. 14364. To us the species seems most properly placed in *Antrodiella* because of its dimitic hyphal system, the small spores, and the translucent to gelatinous consistency when fresh. The cystidia mentioned by Lowe (1966) are difficult to find, and by us only seen in a few places near the pore mouths. These organs are not thickwalled as shown by Lowe (op. cit.), but rather thinwalled and sometimes moniliform or frequently with a nipple, a few also with a swollen apex. They seemingly originate from generative hyphae, which also seems to be Lowe's opinion as his drawing shows one of the cystidia with a clamped septum. We are not quite sure whether it is appropriate to call these organs cystidia or whether they only represent some irregular hyphal growth. The following name is proposed for this taxon:

Antrodiella americana Ryv. & Gilbn., sp. nov.
Fructificatio resupinata, pori angulati ad irregulares. Systema hypharum dimiticum, hyphae generatoriae hyalinae, tenuitunicatae et fibulatae, hyphae skeletales crassitunicatae, sporae ellipsoidae, 2.5-3.5 x 1.5-2.2 µm, hyalinae et tenuitunicatae, non-amyloideae. Typus: USA, Pennsylvania, Clarion County, Cook Forest, June 23, 1942. L. O. Overholts and L. W. White, no. 14364. (PAC).

Trametes americana BPA 316:15. 1935. Illegitimate name, no Latin description. No type indicated. The taxon has been given a valid name on the subspecific level as *Osmoporus odoratus* subsp. *americanus* Fidalgo by Fidalgo (1962:124). However, she neither indicated a type collection nor examined any collection from the type locality which she, for unknown reasons, reported as Pennsylvania, USA. In our opinion, Fidalgo's interpretation of the taxon is correct although we feel that little is gained by giving it a taxonomic rank as a subspecies and we will refer to it as *Gloeophyllum odoratum* (Fr.) Imaz. Those who eventually want to raise Fidalgo's subspecies to specific level must make the combination with reference to her description, and not to the illegitimate name of Overholts', besides selecting a type collection.

Polyporus basilaris Overh. in Bailey, BTBC 68:112. 1941. Type: USA, California, Berkeley, Feb. 14, 1923, on *Cupressus macrocarpa*, Overholts no. 8527.
= *Tyromyces balsameus* (Pk.) Murr. with rare cystidia.

Polyporus canadensis MYCOL 33:97. 1941. Illegitimate name, no Latin description. Type: Canada, Ontario, Ottawa, Davis Swamp, Aug. 16, 1933, J. W. Groves. Overholts no. 16860.
Lowe (1975:44) accepted the taxon in *Tyromyces* and was aware that a Latin diagnosis or description was lacking. Thus, he supplied one, but very unfortunately he described the taxon in *Polyporus* and at the same time made the combination in *Tyromyces*. By doing this, he contravened Article 34 in the ICBN and both the name and the combination are invalid. We accept the species, but feel it should better be placed in *Antrodiella* because of its dimitic hyphal system and very small ellipsoid to oval spores. In changing the name we would like to honour Overholts and propose:
Antrodiella overholtsii Ryv. & Gilbn., sp. nov.
Fructificatio imbricato-sessilis, pileus albus ad brunneus, pori facies alba, pori angulati, 4-6 per mm, contextus albido. Systema hypharum dimiticum, hyphae generatoriae hyalinae, tenuitunicatae ad crassitunicatae et fibulatae, hyphae skeletales restrictae ad contextum. Sporae ellipsoidae ad subglobosae, laeves, hyalinae et non-amyloidae, 2.5-3.5 x 2-3 µm. Type: Canada, Ottawa, Ontario, Aug. 16, 1933, leg. J. W. Groves, in *Picea*. Overholts no. 16860 (PAC).
There is a detailed description in Lowe (op. cit.).

Polyporus canaliculatus MYCOL 33:100. 1941. Illegitimate name, no Latin description. Type: USA, Tennessee, Blount County, Cade's Cove, Aug. 10, 1938, L. R. Hesler and A. H. Smith, Overholts no. 21569.
As already indicated by Pouzar (1972:199), the type is a specimen of *Polyporoletus sublividus* Snell, described in 1936 by Snell (1936:467). Furthermore, the illegitimate name is a homonym of *P. canaliculatus* Pat. from 1898.

Poria carbonica Can. J. Res. Sect. C 21:232. 1943. Type: Canada, British Columbia, Saanichton, Aug. 31, 1938, I. Mounce and J. Straight. Overholts no. 22021.
There is also a good description in Lowe (1966:107) and the species is accepted although we prefer to place it in *Antrodia* because of its dimitic hyphal system with clamped generative hyphae and non-amyloid, hyaline, thinwalled spores.
Antrodia carbonica (Overh.) Ryv. & Gilbn., comb. nov. Basionym: *Poria carbonica* Overh., Can. J. Res. Sect. C 21:232. 1943.

Poria chromatica PPA 13:123. 1939. Illegitimate name, no Latin description. Type: USA, New Hampshire, North Conway, June 8, 1918. Overholts no. 4606.
Lowe (1966:101) stated that the type is a specimen of *Poria crustulina* Bres. Furthermore, Overholts' illegitimate name is also a homonym of *Poria chromatica* (Berk. & Curt.) Cke. from 1888. Pilát (1940:3) described *Poria conwayana* also based on the specimen cited above.

Poria cognata MYCOL 35:248. 1943. Illegitimate name, no Latin description. Type: USA, Tennessee, Gatlinburg, Mt. LeConte, Aug. 15, 1939. Overholts no. 22045.
The type of Overholts' illegitimate species is a specimen of *Poria rancida* Bres., a species we prefer to place in *Tyromyces* because of its monomitic hyphal system with hyaline, smooth, and cylindrical spores. It will be treated in a later paper on Bresadola's polypores.

Polyporus compactus BTBC 49:170. 1929. Type: USA, New Jersey, New Brunswick, Aug. 25, 1920. Overholts and West, no. 7873.
Macroscopically the species is rather similar to *Perenniporia medulla-*

panis (Fr.) Donk, but microscopically it is easily separated because of its slightly larger basidiospores and above all by its dextrinoid, thickwalled chlamydospores which are very abundant in the subiculum. The following combination is proposed:
Perenniporia compacta (Overh.) Ryv. & Gilbn., comb. nov. Basionym: *Polyporus compactus* Overh., Bull. Torrey Bot. Club 49:170. 1929.

Poria conferta BPA 418:25. 1942. Illegitimate name, no Latin description. Type: USA, Pennsylvania, Forest County, Cook Forest, Sept. 18, 1937. Overholts no. 21040.
There is a description in Lowe (1966:111). The species belongs in *Perenniporia* because of its thickwalled and weakly dextrinoid spores and dextrinoid skeletal hyphae, and we propose the following name:
Perenniporia ellipsospora Ryv. & Gilbn., sp. nov.
Fructificatio resupinata, poria facies alba vel cremea, pori angulati, 2-4 per mm. Systema hypharum dimiticum, hyphae generatoriae hyalinae et fibulatae, hyphae skeletales crassitunicatae, 2-4 µm latae, dextrinoideae, sporae ellipsoideae, crassitunicatae, laeves, hyalinae et leviter dextrinoideae. Type: as cited above in PAC.

Poria discolor BPA 418:28. 1942. Illegitimate name, no Latin description. Type: USA, Pennsylvania, Cambria County, Belsano, Oct. 6, 1934. Overholts no. 19332.
The species is accepted and belongs in *Perenniporia* because of its dimitic hyphal system with dextrinoid skeletal hyphae and generative hyphae with clamps. The spores are slightly thickwalled and distinctly dextrinoid in Melzer's reagent. The tubes are white to yellowish when fresh, but change colour and consistency, becoming discoloured and compact-translucent in contrast to the far more light-coloured context.
Perenniporia variegata Ryv. & Gilbn. sp. nov.
Fructificatio resupinata, poria facies alba cum sicca, cremea ad brunnea et cartilaginea et translucida cum siccus, pori circulares vel angulati, 2-3 per mm. Systema hypharum dimiticum, hyphae generatoriae hyalinae, fibulatae, hyphal skeletales crassitunicatae et dextrinoideae, sporae ellipsoideae vel subglobosae, crassitunicatae, dextrinoideae. Type as cited above in PAC.

Polyporus durescens MYCOL 33:98. 1941. Illegitimate name, no Latin description. Type: USA, Ohio, West Elkton, July 28, 1917. Overholts no. 4215. Lowe (1975:65) was aware that the name was illegitimate and validated the name with a Latin description. The species belongs in the difficult group of brown rot species around *Polyporus palustris* Berk. & Curt. and *Fomitopsis meliae* (Underw.) Gilbn. Besides a difference in choice of substrate we see no micro- or macroscopical differences between the former and *P. durescens* and are convinced that they both represent the same variable taxon.

Poria elongata BPA 418:28. 1942. Illegitimate name, no Latin description. Type: USA, Pennsylvania, Kane County, Tionesta Tract, Oct. 3, 1936, on *Acer* log. Overholts no. 21129. The species has been accepted by several authors. Domanski (1973:160) transferred it to *Perenniporia*, which of course did not validate the basionym. We agree with Domanski with regard to the position of the species and have chosen an epithet that refers to the amyloid reaction of the skeletal hyphae. This is unique in the genus where most species either have none or a dextrinoid reaction of the skeletal hyphae in Melzer's reagent.
Perenniporia amylohypha Ryv. & Gilbn. sp. nov.
Fructificatio resupinata, pori facies alba cum viva, flava vel brunnea

cum sicca, pori angulati 3-5 per mm, contextus albus et fibrosus. Systema hypharum dimiticum, hyphae generatoriae hyalinae et fibulatae, hyphae skeletales hyalinae, crassitunicatae leviter amyloideae, sporae ellipsoideae, crassitunicatae leviter dextrinoideae, 4.5-6 x 3-4 µm. Typus: as cited above in PAC. There is an English description in Lowe (1966:120).

Poria flaccida BTBC 65:180. 1938. Type: USA, Louisiana, Kilbourne, Aug. 14, 1939. Overholts no. 14073. = *Rigidoporus xylostromatoides* (Berk.) Ryv. as already indicated by Lowe (1966:39).

Poria grandis MYCOL 35:249. 1943. Type: USA, Tennessee, Great Smoky Mts. Nat. Park, above Naturalists' Headquarters, Aug. 19, 1939. J.A. Stevenson & R.W. Davidson. BPI no. 71421. Illegitimate name, no Latin description. The type of the illegitimate name is a specimen of *Anomoporia albolutescens* (Rom.) Pouz. as already indicated by Lowe (1966:59).

Poria illudens Overh. & Lowe MYCOL 38:207. 1946. Type: USA, Vermont, Brandon, H.G. Eno. Overholts no. 19193. = *Wrightoporia subrutilans* (Murr.) Ryv. as indicated in Ryvarden (1982:147).

Polyporus illudens MYCOL 33:95. 1941. Type: USA, Idaho, Bovill, Sept. 26, 1920. A.S. Rhoads. Overholts no. 14302. Illegitimate name, no Latin description. The type specimen is *Albatrellus dispansus* (Lloyd) Canf. & Gilbn. as already indicated by Imazeki and Toki (1954) and Canfield and Gilbertson (1971).

Poria inflata PPA 13:123, 1939. Illegitimate name, no Latin description. Type: USA, Ohio, Oxford, Nov. 21, 1911. Overholts no. 279. The species was transferred to *Macrohyporia* by Ryvarden and Johansen (1980) which of course did not validate the basionym. *Macrohyporia* is typified by *Polyporus dictyoporus* Cooke, a species characterized by slightly thickwalled subglobose spores, rather different from those of *Poria cocos* (Schw.) Wolf and *Poria inflata* Overh., two North American species which have been transferred to the genus. After examination of the North American species we propose a new genus for them, and name it in honour of F.A. Wolf who was the first to describe the perfect stage of *Sclerotium cocos* Schw.
Wolfiporia Ryv. & Gilbn., gen. nov. Fructificatio resupinata , effusa, pori cremei, ochracei vel brunneoli. Systema hypharum monomiticum vel subdimiticum, hyphae generatoriae tenuitunicatae, afibulatae usque ad 25 µm latae, hyphae skeletales ramosae, sporae tenuitunicatae, hyalinae , cylindricae ad ellipsoideae, non-amyloideae. Type species: *Wolfiporia cocos* (Wolf) Ryv. & Gilbn., comb. nov. Basionym: *Poria cocos* Wolf, J. Elisha Mitchell Sci. Soc. 38:134-135. 1922. The taxon given the illegitimate name *Poria inflata* by Overholts should also be placed in *Wolfiporia* with the following description:
Wolfiporia dilatohypha Ryv. & Gilbn., sp. nov.
Fructificatio resupinata, alba ad cremea, pori angulati, 3-5 per mm. Systema hypharum monomiticum, hyphae generatoriae afibulatae, usque ad 25 µm latae, sporae ellipsoideae, hyalinae, tenuitunicatae et non-amyloideae, 4-5 x 2.5-3.5 µm. Typus: USA, Ohio, Oxford, Nov. 21, 1911. Overholts no. 279 in PAC. There is an English description in Lowe (1966:29).

Poria lenta Overh. & Lowe MYCOL 38:210. 1946. Type: USA, New York. Warrensburg, J. Lowe no. 1767. =*Wrightoporia lenta* (Overh. & Lowe) Pouz. For a description, see Lowe (1966:11) or Ryvarden (1982:147).

Polyporus lineatus MYCOL 33:101. 1941. Illegitimate name, no Latin description. Type: USA, Pennsylvania, Center County, Houserville, Nov. 11, 1921, on log of *Pinus rigida*. Overholts no. 8023. = *Tyromyces undosus* (Pk.) Murr. Lowe (1975:32) accepted the species and was aware that the name was illegitimate and consequently gave a Latin description. Unfortunately, as he described the species in *Polyporus* and simultaneously transferred it to *Tyromyces*, he contravened Article 34 in ICBN and made both names invalid.

Poria magnahypha BPA 418:31. 1942. Illegitimate name, no Latin description. Type: USA, Pennsylvania, Elk County, Allegheny Nat. Forest, July 30, 1939. Overholts no. 22038. As already indicated by Lowe (1966:28), the type represents a specimen of *Wolfiporia cocos* (Wolf) Ryv. & Gilbn.

Poria mappa Overh. & Lowe. MYCOL 38:210. 1946. Type: Canada, British Columbia, Enderly, D.C. Buckland. Overholts no. 24445. = *Tyromyces mappa* (Overh. & Lowe) Ryv. For a description, see Lowe (1966:77).

Poria microspora Overh. in Nobles, Can. J. Res. Sect. C 21:224. 1943. Type: Canada, British Columbia, Queen Charlotte Islands, May 15, 1942. J.E. Bier. Overholts no. 10724. The type is a specimen of *Tyromyces placenta* (Fr.) Ryv. as already indicated by Lowe (1966:81).

Poria notata BPA 418:33. 1942. Illegitimate name, no Latin description. Type: USA, Pennsylvania, Lycoming County, Ralston, June 3, 1938. Overholts no. 21135. The type is a specimen of *Poria subvermispora* Pilât as already indicated by Lowe (1966). This species is monomitic with a white rot, and we propose the following new combination: *Spongiporus subvermisporus* (Pilât) Ryv. & Gilbn. comb. nov. Basionym: *Poria subvermispora* Pilât, Studia Bot. Czech. 3:2. 1940.

Fomes occidentalis MYCOL 33:101. 1941. Illegitimate name, no Latin description. Type: USA, Idaho, Saint Maries, Nov. 18, 1911. Overholts no. 21572. Lombard et al. (1972:352) were aware that Overholts' species was without a valid name and they supplied a Latin description, which they, however, ascribed to Overholts. It may be discussed whether this is reasonable as Overholts himself had been dead over 20 years when the validation was done. The authorship should probably be cited as Overh. ex Lombard, David. & Gilbn. A complicating point in this matter is that Gilbertson made a combination in *Phellinus* on the same page, and the whole validation is almost in contravention with Article in the ICBN. The appropriate sentence in this article is the following: "When, on or after 1 Jan., 1953, two or more different names (so called alternative names) are proposed simultaneously for the same taxon by *the same author* (our italics), none of them is validly published." It is apparent that when Lombard, Davidson, and Gilbertson described the species (based on a name proposed by Overholts) and Gilbertson alone made the combination, there is no contravention of the ICBN although some may think that this is an interpretation more to the letter than to the spirit of the ICBN. However, to avoid another name for this taxon we accept the procedure referred to above as a proper validation of Overholts' original illegitimate name. Besides the description of Lombard, Davidson, and Gilbertson (op. cit.) there is also one in Gilbertson (1979:70).

Poria oleagina BPA 418:34. 1942. Illegitimate name, no Latin description. Type: USA, New Hampshire, North Conway, Aug. 10, 1920, W. H. Snell 557. We accept the species in *Antrodia* and propose the following name:

Antrodia sordida Ryv. & Gilbn., sp. nov.
Fructificatio resupinata, pori facies alba ad cremea cum viva, sordida et fragilis cum sicca, pori circulares ad angulati, 4-6 per mm. Systema hypharum dimiticum, hyphae generatoriae fibulatae, hyphae skeletales crassitunicatae, hyalinae, sporae ellipsoideae, hyalineae, non-amyloideae, 3.5-5 x 1.5-2 µm. Typus: as cited above in PAC. There is an English description in Lowe (1966:99).

Fomes portoricensis Overh. in Seaver & Chardon, Sci. Surv. Puerto Rico & Virgin Isl. 8:158. 1926. Type: Puerto Rico, Rio Piedras, J.R. Johnson, Nov. 30, 1911. = *Phellinus portoricensis* (Overh.) Fidalgo. There is a description in Fidalgo (1968:111) and in Ryvarden and Johansen (1980:197).

Fomes repandus MYCOL 44:224. 1952. Type: USA, Idaho, Upper Priest River, July, 1925, C. Epling. Overholts no. 11648. = *Phellinus repandus* (Overh.) Gilbn. There is a detailed description in Lombard et al. (1972:357) and in Gilbertson (1979:74).

Poria rubens Overh. & Lowe, MYCOL 38:211-212. 1946. Type: Canada, British Columbia, Owl Creek, June 15, 1930, J. R. Hansbrough no. 40660. Overholts no. 13984. = *Hapalopilus salmonicolor* (Berk. & Curt.)Pouzar, teste Lowe (1966:80).

Polyporus scrobiculatus MYCOL 33:91. 1941. Illegitimate name, no Latin description. Type: USA, Pennsylvania, Huntingdon County, Stone Creek, Oct. 3, 1937. Overholts no. 20376. The species is accepted and is characterized by a white, pileate, annual fruitbody with clamped generative hyphae and smooth, thinwalled and hyaline spores. Thus, *Spongiporus* is the appropriate genus.
Spongiporus lateralis Ryv. & Gilbn., sp. nov.
Fructificatio dimidiata, glabra vel velutina, alba ad cremea, pori facies alba, pori angulati ad irregulares, 2-4 per mm. Systema hypharum monomiticum, hyphae generatoriae fibulatae, 2-5 µm latae, sporae ellipsoideae, hyalinae, tenuitunicatae et non-amyloideae, 4-6 x 2.5-4 µm. Typus: as cited above in PAC. There is an English description in Overholts (1953:260).

Poria stenospora PPA 13:125. 1939. Illegitimate name, no Latin description. Type: USA, Washington, Newman Lake, Aug. 1, 1936, C. R. Stillinger. Overholts no. 21564. = *Dichomitus squalens* (Karst.) Reid, resupinate condition.

Polyporus subcartilagineus MYCOL 33:90. 1941. Illegitimate name, no Latin description. Type: Canada, Quebec, Nataku Depot, 80 miles N. of Maniwaka, Sept. 27, 1938, A. W. McCallum. Overholts no. 21573. The type is a specimen of *Parmastomyces transmutans* (Overh.) Ryv. & Gilbn. (see below).

Polyporus sylvestris MYCOL 33:94. 1941. Illegitimate name, no Latin description. Type: Canada, British Columbia, Vancouver Island, Cowichan Lake, C. G. Riley, Aug., 1929. Overholts no. 13026. Pouzar (1972:199) validated the name and pointed out that it was very closely related to *Polyporoletus sublividus* Snell, but could be separated by having a finer ornamentation on the spores and a slightly less scaly pileus. After having examined specimens from both East and West America and photographed the spores in a scanning electron microscope, we are convinced that they represent the same species as we see no difference in spore ornamentation in specimens from the two areas.

Polyporus transmutans MYCOL 44:226. 1952. Type: USA, Pennsylvania, McKean County, Westline, Sept. 10, 1940, on *Prunus serotina*, W. A. Campbell and R. W. Davidson. Overholts no. 22971. The type is a specimen of *Parmastomyces kravtzevianus* (Bond. & Parm.) Kotl. & Pouz. However, Overholts' name has priority and the following combination is proposed: *Parmastomyces transmutans* (Overh.) Ryv. & Gilbn., comb. nov. Basionym: *Polyporus transmutans* Overh., Mycologia 44:226. 1952.

REFERENCES

CANFIELD, E.R. and R.L. GILBERTSON. 1971. Notes on the genus *Albatrellus* in Arizona. Mycologia 63:964-971.- DOMANSKI, S. 1973. *Poria elongata* in Poland. Persoonia 7:155-160.- FIDALGO, M.E.P.K. 1962. The genus *Osmoporus* Sing. Rickia 1:95-138.- FIDALGO, O. 1968. *Phellinus pachyphloeus* and its allies. Mem. N.Y. Bot. Gard. 17(2):109-147.- GILBERTSON, R.L. 1979. The genus *Phellinus* (Aphyllophorales, Hymenochaetaceae) in western North America. Mycotaxon 9:51-89.- IMAZEKI, R. and S. TOKI. 1954. Higher fungi of Asakawa Experiment Forest. Bull. Gov. Forest Exp. Sta. Tokyo 67:19-71.- LOMBARD, F., R.W. DAVIDSON, and R.L. GILBERTSON. 1972. Studies of two species of *Phellinus* in western North America. Mycopath. et Mycol. Appl. 46:351-356.- LOWE, J.L. 1966. Polyporaceae of North America. The genus *Poria*. State Univ. N.Y. Coll. Forestry Syracuse Univ. Tech. Publ. 90:1-193.- LOWE, J.L. 1975. Polyporaceae of North America. The genus *Tyromyces*. Mycotaxon 2:1-82.- OVERHOLTS, L.O. 1953. The Polyporaceae of the United States, Alaska, and Canada. Univ. Michigan Press, Ann Arbor.- PILÁT, A. 1940. Species nova boreali americanae generis *Poria*. Stud. Bot. Czech. 3:1-4.- POUZAR, Z. 1972. Contribution to the knowledge of the genus *Albatrellus* (Polyporaceae). I. A conspectus of species of the North Temperate Zone. Česka Mykol. 26:194-200.- RYVARDEN, L. 1982. Synopsis of the genus *Wrightoporia*. Nordic J. Bot. 2:145-149.- RYVARDEN, L. and I. JOHANSEN. 1980. A preliminary polypore flora of East Africa. Fungiflora, Oslo.- SNELL, W.H. 1936. Notes on boletes V. Mycologia 28:463-475.

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THE SYNNEMATOUS HYPHOMYCETE MORRISOGRAPHIUM PILOSUM (EARLE) MORELET SYNONYMOUS WITH A "COELOMYCETE", "CORNULARIA" PERSICAE (SCHW.) SACC.

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ABSTRACT

The synonymy of Morrisographium persicae comb. nov. is traced, with nomenclatorial notes on discarded names, and the formal transfer of the epithet "persicae" proposed.

INTRODUCTION

In anamorph taxonomy, students of the hyphomycetes on the one hand and of coelomycetes on the other have often operated in isolation. Nowhere is this more clearly demonstrated than in the treatment of Periconia persicae, the fungus at which Schweinitz (1822) marvelled in these words "Copia incredibili fere omnes ramos ramulosque et truncos emortuarum Persicarum investit et quasi spinulos reddit..." He further noted that the fungus occurred on minor native species of Prunus as well.

THE SEQUENCE OF SYNONYMIES

While Fries (1832), who had the Schweinitz collection at hand, catalogued it under Sporocybe among hyphomycetes, subsequent workers frequently used the epithet in genera which contained at least some coelomycete species. Thus both Ellis (1883) and Rabenhorst (1883) placed it in Sphaeronema, and Saccardo (1884) in Karsten's new genus Cornicularella (Karsten, 1884)—to which he applied, without explanation, the shortened form Cornularia (thus creating a superfluous name). That it does not belong in Cornicularella has been demonstrated by Di Cosmo (1978).

Ellis and Everhart (1891) deferred to Saccardo's usage and called their new species collected on elm *Cornularia ulmicola*. Examination of the type collection clearly shows it to be much like the peach-twig fungus, *C. persicae* (Schw.) Sacc., but specifically distinct. The name *Cornularia* recurs time and again in classic herbarium specimens and distributed exsiccati specimens of this era.

Jaczewski (1898) in his monographic treatment of *Sphaeronaema* segregated *S. persicae*, with other species, into a new genus *Pseudographium* Jacz. He, however, included the species on which Saccardo (1884) had founded his *Sphaerographium*, *S. lonicerae* Fuckel (=*S. squarrosum* Riess, fide Höhnel (1915)). He thereby put his intended new genus into obligate synonymy under *Sphaerographium*, as pointed out by Sutton (1977).

When von Höhnel (1915) revised *Pseudographium*, his newly delimited taxon was so drawn as to accommodate *P. persicae* and certain clearly related species. He pointed out that *Pseudographium squarrosum* (Riess) Jacz. was the type of the genus *Sphaerographium* and as such could not be assigned to a new genus, noting that "Er ist auch ganz anders gebaut, passt nicht in seine Gattung und wurde von Jaczewski vollig verkannt". Notwithstanding his sound mycological judgment, v. Höhnel's revised *Pseudographium* becomes a later homonym of *Pseudographium* Jaczewski and hence inadmissible under the Rules as a generic designation.

When Earle (1897) described the "peach-twig" organism as new, he recognised it as a stilbaceous hyphomycete in *Isariopsis*, as *I. pilosa* Earle.

Ferraris (1909) transferred Earle's *Isariopsis pilosa* to *Phaeoisariopsis* on the basis of the dark synnemata characteristic of the fungus.

Morris (1966) described a new genus and new species founded upon a fungus developed in moist chamber culture of bark from *Ulmus americana* L., *Phragmographium ulmi* Morris. Two years later, Jong and Morris (1968), in a monograph of *Phaeoisariopsis* excluded *P. pilosa* (Earle) Ferraris on the basis of conidiogeny differing radically from the process in other species of the genus: they placed this fungus as

Phragmographium pilosum (Earle) Morris, noting correctly that "*P. pilosa* is congeneric with *Phragmographium ulmi*, the type of *Phragmographium*".

Morelet (1968) pointed out that "*Phragmographium*" Morris constitutes a later homonym for *Phragmographum* P. Henn., a pyrenomycete genus. He proposed a replacement name *Morrisographium* in honor of Everett Morris, author of "Phragmographium" and placed *I. pilosa* in the genus as "Espèce type", *Morrisographium pilosum* (Earle) Morelet.

Saccardo (1915) contributed another superfluous epithet, *Harpographium magnum* Sacc. in a genus to which the organism he had at hand clearly does not belong.

IDENTITY OF "CORNULARIA" PERSICAE AND MORRISOGRAPHIUM PILOSUM

While the type material of *Periconia Persicae* Schweinitz (1822) from North Carolina is apparently not extant, an authenticated collection stamped "Herb. E. Fries" has been made available for study. This fungus, collected in South Carolina and labelled as "*Sporocybe Persicae* Fries "[scr. Fries] proves to be identical with material of the type of *Isariopsis pilosa* Earle, collected in Alabama on the same host, i.e. twigs of peach. Thus we are presented with an earlier epithet which must take precedence over *Morrisographium pilosum* (Earle) Morelet because it was validly published three-quarters of a century earlier. The formal combination is hereby proposed as *Morrisographium persicae* (Schw.) W.I. Illman and G.P. White.

The following nomenclator sets forth the synonymy of the species as known to us:

Morrisographium persicae (Schw.) W.I. Illman and G.P. White, comb. nov.

≡*Periconia persicae* Schw. Schriften Naturf. ges. Leipzig. 1:125. 1822.

≡*Sporocybe persicae* (Schw.) Fr., Syst. Mycol., 3:342. 1832.

≡*Sphaeronema persicae* (Schw.:Fr.) Ell. North Amer. Fungi. No. 946*. 1883.

≡*Cornularia persicae* (Schw.) Sacc., Syll. Fung. 3:599. 1884.

≡*Pseudographium persicae* (Schw.) Jacz., Nouv. Mem. Soc. Imp. Nat. Moscow. 15:370. 1898.

≡*Pseudographium persicae* (Schw.) Jacz. emend. Hohn. Sitzungsber. Akad. Wiss. Wein, Math.-Naturwiss. Kl., Abt. 1. 124:49-159. 1915.

=*Isariopsis pilosa* Earle, Bull. Torrey Bot. Club 24:30. 1897.

≡*Phaeoisariopsis pilosa* (Earle) Ferraris, Ann. Mycol. 7:280. 1909.

≡*Phragmographium pilosum* (Earle) Morris, in Jong & Morris, Mycopath. Mycol. Appl. 34:264. 1968.

≡*Morrisographium pilosum* (Earle) Morelet, Taxon 17:528. 1968.

=*Harpographium magnum* Sacc., Ann. Mycol. 13:121. 1915.

* designated neotype, deposited in DAOM in the exsiccatus, North American Fungi (Ellis) no. 946; the collection typifies well the species in question, is fertile with ample supply of conidia and is widely represented in a published set of exsiccati, providing numerous isoneotypes. Saccardo (1884) cited this number as an example of *Cornularia persicae* (Schw.) Sacc.

Critical comparisons of *Morrisogaphium persicae* and known congeneric fungi (variously assigned by previous authors) are to be published elsewhere in a following paper (W.I. Illman and G.P. White, 1983) where the numerous specimens studied are listed.

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We wish to acknowledge with gratitude the provision of authentic material of Sporocybe persicae (Schw.) Fr. from Herb. E. Fries, by the curator of Herb. UPS, Uppsala, Sweden and of the type of Isariopsis pilosa Earle by the curator Herb. BPI, Beltsville, MD. Access to the National Fungus Collections and exsiccati in Herb DAOM and provision of working facilities in the Biosystematics Research Institute are deeply appreciated by the senior author during his tenure of sabbatical from Carleton University, Ottawa. Our thanks to Dr. C.J.K. Wang for her critical review of the manuscript.

REFERENCES

DiCosmo, F. 1978. A revision of Corniculariella. Can. J. Bot. 56:1665-1690.

Earle, F.S. 1897. New species of Fungi imperfecti from Alabama. Bull. Torrey Bot. Club 24: 28-32.

Ellis, J.B. 1883. Sphaeronema persicae (Schw. ex Fr.) Ell. North Am. Fungi. #946, Apr. 26.

Ellis, J.B. & Everhart, B.M. 1891. New species of fungi from various localities. Proc. Acad. Nat. Sci., Phil. 43: 76-93.

Ferraris, T. 1909. Osservazioni micologiche su specie del gruppo Hyphales (Hyphomycetae). Ann. Mycol. 7: 273-286.

Fries, E.M. 1832. Systema mycologicum. Vol. 3. 524 p. Lund.

Höhnel, F. von. 1915. Fragmente zur Mykologie (XVIII. Mitteilung, Nr. 876 bis 943). Sitzungsber. Akad. Wiss. Wien, Math.-Naturwiss. Kl., Abt. 1. 124: 49-159.

Illman, W.I. and White, G.P. Morrisographium Morelet: Comparative studies of named species. In prep. for publ.

Jaczewski Von A. v. 1898. Monographie du genre Sphaeronaema Fries. Nouv. Mem. Soc. Imp. Nat. Moscou 15: 278-386.

Jong, S.-C. & Morris, E.F. 1968. Studies on the synnematous Fungi Imperfecti III. Phaeoisariopsis' Mycopath. Mycol. Appl. 34: 263:272.

Karsten, P.A. 1884. Fragmenta mycologica. XIV. Hedwigia, 23: 57-58.

Morelet, M. 1968. Sur l'illégitimité du genre Phragmographium (Stilbellaceae). Taxon 17: 528.

Morris, E.F. Studies on the synnematous Fungi Imperfecti-I. Mycopath. et Mycol. Appl. 28: 97-101.

Rabenhorst, L. 1883. Sphaeronema persicae no. 3198, Fungi Eur. Exs.

Saccardo, P.A. 1884. Sylloge fungorum, Vol. 3. 860 p. Pavia.

______________ 1915. Notae mycologicae. Ann. Mycol. 13: 115-138.

Schweinitz, L.D. de 1822. Synopsis Fungorum Carolinae superioris. Schriften Naturf. Ges. Leipzig. 1:20-131.

Sutton, B.C. 1977. Nomenclature of generic names proposed for Coelomycetes. Mycol. Pap. no. 141, C.M.I., Kew, England.

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WOOD DECAY FUNGI OF COSTA RICA[1]

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ABSTRACT

The first part of a comprehensive report on wood decay fungi of Costa Rica that includes 32 species selected at random from a total of 179 species that have been collected in this country by others between 1896 and 1979 and by the authors between 1979 and 1981.

Few of the species have been rarely collected before in Costa Rica, like *Coriolus sector*; *Bjerkandera adusta*; *Trichaptum biformis*; *Phellinus gilvus*; *Cyclomyces iodinus*; *Ceriporia purpurea*; *Coriolus pavonius*; *Coltricia perennis*; *Polyporus guianensis*; and *Polyporus brumalis* (first record for Costa Rica). *Coriolus sobrius* is only known from the type and a second collection has been reported from Costa Rica (Lowe, 1976).

In Costa Rica the study of Polyporaceae has received more attention from foreign mycologists than other groups of fungi. In literature up to the present a total of 108 species of the above family have been reported for the country (Covington, 1980; Lowe, 1963; 1966; 1976; Murrill, 1915).

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Seventy one species of the 179 species that have been collected represent new records for the country. The classification adopted here is based mainly on Overholts (1953), Ainsworth (1973), Murrill (1915) and Ryvarden (1972; 1973). In the list of species which are order alphabetically, the collection stations of the authors are recorded with reference to the map (Fig. 1), in which the provinces of Costa Rica are designated by Roman numerals and the localities by Arabic numerals in parenthesis. Those species preceded by an asterisk (*) have been reported; all others are new records for the country.

The following abbreviations are used to designate collections: R= Rowlee; TU= Tulane University; C= Covington; USJ= University of Costa Rica Herbarium; CR= National Museum Herbarium, Costa Rica; JCV= Authors collections. The following codes for distribution: NA= North America; SA= South America; CB= Caribbean; CA= Central America; CR= Costa Rica; A= Africa; E= Europe; AS= Asia.

This paper is a contribution to knowledge of the types and distribution of wood decay fungi in Costa Rica, and to provide new research paths as to the economic implications of these fungi in the lumber industry and their important role in forest ecosystems.

Specimens are deposited in the Herbarium Fungi Collection of the School of Biology, University of Costa Rica. Duplicates have been distributed to other institutions.

The synonyma for the different genera have been taken from Overholts (1953), Murrill (1915), Lowe (1963 ; 1966; 1976), Ryvarden (1972; 1973) and Index of Fungi.

Unless otherwise stated the description of the specimens agree with that given by Overholts.

LIST OF SPECIES

1* _Bjerkandera adusta_ (Willd. : Fr.) Karst. Medd. Soc. Faun. Fl. Fenn. 5:38, 1879.
Polyporus adustus Willd. : Fr., Syst. Myc. 1:363, 1821.

Distribution: NA; SA; CR; A; AS; E. Costa Rica: USJ 21029 24-XI-79; I (1) 2,048 m.; USJ 31337, 11-XI-79; IV (4) 1,804 m.; USJ 21030, 13-III-81; IV (3) 1,804 m. Reported also from New Zealand (Cunningham, 1965).

Comments: The specimens are typical of the species, although some of the sporocarps are wider reaching up to 8 cm. It is widely distributed in North and South America but apparently

not very common in our country. There is one collection made by Standley & Valerio in Cerro Las Vueltas, San Jose, under the name Polyporus dissitus Berk. & Br. A piece of the original collection is placed in the Herbarium of the College of Forestry, Syracuse, N.Y. A duplicate of the above is in the USJ under #21387. The collections here mentioned represent the fourth record for Costa Rica. Covington (1980) listed it for Costa Rica under TU 7757. This fungus causes a rot of the white decay type.
Habitat: On fence posts.

2.* Ceriporia purpurea (Fries) Donk., Konn. Nederl. Akad. Wetensch. Amst. Proc. Ser. C. 74 no. 1:28, 1971.
Poria Bresadolae Bourd. & Galz., Bull. Soc. Mycol. France 41:222, 1925.

Comments: This species is listed by Covington (1980) based on a specimen placed in the Herbarium of Tulane University under #7853. Collected by Welden (1972) in Escazu. San Jose and determined by J.L. Lowe. A small sample is placed in the USJ under #21358. Also reported from Africa and Europe.

3. Coltricia perennis (L. : Fr.) Murr., Journal Mycol. 9:91, 1903.
Polyporus perennis L. : Fr., Syst. Myc. 1:350, 1821.

Distribution: NA; E; A; AS; CR. Costa Rica: USJ 21493, 25-IX-80; I (4) 3,075 m. Reported also from New Zealand (Cunningham, 1965).

Habitat: On the ground and in fireplaces, along clay banks, or in forest trails, very rarely on rotten wood.

4.* Coriolus pavonius (Hook.) Murr., NAF 9:25, 1907.
Polyporus pavonius (Hook.) Fries, Epicr. Syst. Myc. p. 477, 1836-1838.

Distribution: NA; CR.

Comments: There is only one collection made by Welden (TU 7808). A duplicate is in the USJ under #21427.

5. Coriolus sector (Ehrenb. : Fr.) Pat., Tax. Hymen 94, 1900.
Polyporus sector Ehrenb. : Fr., Syst. Myc. 1:505, 1821.

Distribution: NA; CR. Costa Rica: USJ 21486, 25-VII-79; I (9) 1,615 m.; USJ 21451, 8-II-80; VI (1) 1,330 m.; USJ 21449, 28-X-79; I (3) 2,021 m.; USJ 21450, 13-III-81; III (5) 1,040 m.; J.L. Lowe 12934, 13342; I (2), I (10) respectively.

6.* Coriolus sobrius (B. & C.) Murr., Bull. Torrey Bot. Club 32:649, 1906.
Polyporus sobrius B. & C., Linn. Soc. Bot. Jour. 10: 316, 1868.

Distribution: CB; CR.

Comments: The type is from Cuba, Wright 107, and the only collection from Costa Rica is at the Missouri Bot. Gard. (Lowe, 1976).

7. Cyclomyces iodinus (Mont.) Pt., Tax. Hymén. 94, 1900.
Polyporus iodinus Mont., Ann. Sci. Nat. Bot. II, 16: 108, 1841.

Distribution: NA; SA; CA; CB; CR. Costa Rica: USJ 21411, 28-X-79; I (3) 2,221 m.; USJ 21412, 11-XI-79; IV (4) 1,804 m.; USJ 21483, 8-VIII-80; VI (4) sea level; USJ 21414, 25-IX-80; I (4) 2,700 m.; USJ 21413, 5-VII-81; VI (7) sea level; USJ 9831; 9830; 9829 (collected by J.L. Lowe, 1963). Reported also from Fiji (Cunningham, 1965).

Comments: Our collections agree with Overholts' descriptions except that the sporophores are 0.8-4.0 cm x 0.6-6.0 cm, hyphae are 3 μ in diameter, and spores 2.0-4.0 x 1.0-2.0 μ.

8.* Hexagonia hydnoides (Sw. : Fr.) Fidalgo, Mem. New York Bot. Gard. 17(2):35-108, 1968.
Polyporus hydnoides Swartz: Fries, Elench. Fung. I, p. 107, 1828.

Distribution: NA; SA; CB; CA; A; CR. Costa Rica: USJ 21400, 20-VII-79; VI (2) 208 m.; USJ 21408, 11-X-79; VII (2) 86 m.; USJ 21404, 11-X-79; VII (3) 144 m.; USJ 21402, 11-X-79; VII (2) 86 m.; USJ 21403, 11-X-79; VII (4) 80 m.; USJ 21397, 12-X-79; VII (5) 150 m.; USJ 21396, 11-X-79; VI (2) 208 m.; USJ 21398, 14-XI-79; VII (6) 29 m.; USJ 21395, 29-I-80; VI (4) 26 m.; USJ 21399, 1-I-80; VI (4) sea level; USJ 21487, 7-II-80; V (1) 20 m.; USJ 21406, 7-III-80; V (4) 62 m.; USJ 21488, 7-III-80; V (1) 3 m.; USJ 21480, 4-I-80; VI (4) sea level; USJ 21392, 4-III-80; III-(1) 428 m.; USJ 21481, 4-III-80; III(1) 428 m.; USJ 21494, 8-III-80; VII (1) 200 m.; USJ 21407, 10-IV-80; VI (5) 7 m.; USJ 21482, 26-IX-80; VI (6) 9 m.; USJ 21393, 10-X-80; V (2) 3m.; USJ 21394, 10-X-80; V (3) 32 m.; USJ 21410, 13-III-81; III (5) 1,040 m.; USJ 21409, 13-III-81; IV (2) 37 m.; USJ 21466, 8-V-81; III (2) 43 m.; TU 9068.

Comments: A very common and widely distributed species in the lowlands of Costa Rica, especially between 0-450 m. Habitat: On treated and untreated wood in several types of constructions (walls, fence posts, towers) in the coastal zones. The decay is a white rot.

9.* Laetiporus sulphureus (Bull.) Murr., Mycol. 12:11, 1920.
Polyporus sulphureus Bull. : Fr., Syst. Myc. 1:357, 1821.

Distribution: NA; CB; A; E; AS; CR. Costa Rica: JAS-MNC 645; I (11) 1,385 m.; USJ 9848; I (2) 1,852 m. (Lowe #12954); TU 6879.

Comments: Specimen 645 was found growing on a tree in an open place. Sporophore forming imbricate clusters, orange above when fresh, changing to white when dry; fleshy, watery but firm, rigid when dry. Pores sulphur yellow changing to white when dry. Upper surface of pileus glabrous; context watery white when fresh, pure white when dry, 0.2-2 cm thick. Spores ovoid, hyaline, smooth-walled. It causes a red-brown heart rot of the carbonizing type.

10.* Microporellus holotephrus (Berk. & Curt.) Murr., Bull. Torrey Bot. Club 32, 1905.
Polyporus holotephrus Berk. & Curt., Linn. Soc. Bot. Jour. 10:315, 1868.

Distribution: SA; CB; CR. Costa Rica: The species is listed by Covington (1980) under TU 4779, the only record for Costa Rica. No duplicate is in USJ.

11. Microporellus obovatus (Jungh.) Ryv., Norw. J. Bot. 19 (3-4):232, 1972.
Polyporus polygrammus Berk. & Curt., Linn. Soc. Bot. Jour. 10:307, 1868; Polyporus Ravenalii Berk. & Curt., Grevillea I:38, 1872.

Distribution: NA; SA; CB; A; AS; CR.

12. Nigroporus vinosus (Berk.) Murr., Bull. Torrey Bot. Club 32:361, 1905.
Polyporus vinosus Berk., Ann. Mag. Nat. Hist. II, 9:195, 1852.

Distribution: NA; SA; CA; CB; A; AS; CR. Costa Rica: USJ 21460, 7-XII-79; V (8) sea level; USJ 21497, 4-III-80; III (1) 428 m.; USJ 21332, 13-XI-80; I (6) 840 m.

Comments: It agrees with Overholts' description except sporophores 1.0-2.5 x 1.5-5.5 cm., vinaceous brown. Context 1.0-1.5 mm. Pore surface smoky brown. Spores hyaline, allantoid, smooth-walled, 1.0-1.5 x 3.0-4.0 μ. Cystidia none. Context hyphae 4 μ, thick-walled. Habitat: On dead wood.

13. *Phellinus gilvus* (Schw.) Pat., Essai Tax. Hymén. 94, 1900.
Polyporus gilvus (Schw.) Fries, Elench. Fung. p.104, 1828; *Hapalopilus gilvus* (Schw.) Murr., Bull. Torrey Bot. Club 31:418, 1904; *Polyporus licnoides* Mont., Ann. Sci. Nat. ser. 2, vol. 13:204, 1846.

Distribution: NA; A; AS; CB; SA; E; CA; CR. Costa Rica: USJ 21379, 8-II-80; VI (1) 1,330 m.; USJ 21390, 7-III-80; II (3) 1,441 m.; USJ 21422, 30-VIII-79; II (4) 1,445 m.; USJ 21420, 20-X-79; I (5) 1,205 m.; USJ 21419, 11-X-79; VII (2) 86 m.; USJ 21469, 14-XI-79; VII (6) 29 m.; JCV 197-79, 13-XI-79; 1 (5) 1,205 m.; USJ 21418, 21-XI-79; I (6) 804 m.; USJ 21476, 13-XI-80; I (6) 840 m.; USJ 21421, 2-VI-81; I (7) 904 m.; USJ 21415, 20-III-81; IV (2) 37 m.

Comments: *P. licnoides* has been considered the tropical counterpart of *P. gilvus* since it is softer, thinner and marked with many narrow zones, but now they are considered synonyms. The decay is a white rot with a tendency to assume a rusty yellow coloration or with rusty spots, particularly under the bark.

Covington (1980) listed *Polyporus gilvus* Schw. var. *congregatus* Bomm. & Rouss., Bull. Soc. Roy. Bot. de Bélgique 35:351, 1896. This is the only record for the species in Costa Rica. No duplicate is in USJ.

14.* *Phylloporia frutica* (Berk. & Curt.) Ryv., Norw. J. Bot. 19:235, 1972.
Inonotus fruticum (Berk. & Curt.) Murr., Torrey Bot. Club Bull. 31:601, 1904; *Polyporus fruticum* Berk. & Curt., Linn. Soc. Bot. Jour. 10:310, 1868.

Distribution: NA; CB; AS; A; CR. Costa Rica: The only record for the country is that mentioned by Covington (1980). No duplicate is in USJ.

15.* *Polyporus arcularius* Batsch: Fr., Syst. Myc. 1:342, 1821.
Polyporus arculariformis Murr., Bull. Torrey Bot. Club 31:1904.

Distribution: NA; CB; A; E; AS; CR. Costa Rica: USJ 21346, 13-XI-79; II (1) 646 m.; USJ 21347, 24-XI-79; I (1) 2,048 m.; USJ 18279; 28-XII-79; II (2) 2,145 m.; USJ 21344, 13-III-81; IV (3) 1,804 m.

Comments: Sporophores distinctly stipitate; pileus 3-4 cm broad; Context yellowish. Stem central, 1-3 cm long. A collection is placed at TU under #9238. This fungus is not an important species among those that cause decay.

Habitat: On twigs and buried wood.

16.* Polyporus Blanchettianus Berk. & Mont., Ann. Sci. Nat. Bot. III, 11:238, 1839.
Polyporus nephridius Berk., Hook. J. Bot. 8:195, 1856.

Distribution: NA: SA; CR. Costa Rica: USJ 21356, 7-XII-79; V (1) sea level; USJ 21355, 10-26-79; IV (1) 1,530 m.; USJ 21357, 10-IX-80; I (2) 2,221 m.

Comments: It agrees with Overholts' description (1953), except the pileus that is up to 5.5 cm long and 3.5 cm broad, striate; spores 5.0 x 2.5 µ. It has not been reported as an important decay fungus. Habitat: On dead wood in wet and shady places. Reported also from Asia and Africa (Ryvarden & Johansen, 1980).

17. Polyporus brumalis Pers. : Fr., Syst. Myc. 1:348, 1821.
Polyporus Polyporus (Retz.) Murr., Bull. Torrey Bot. Club 31, 1904; Boletus Polyporus Retz., Vet. Ac. Handl. 253, 1769; Polyporellus brumalis Karst. Medd. Soc. Faun. et Fl. Fenn. 5:37, 1879; Polyporellus Polyporus Murr., J. Myc. 9:93, 1903.

Distribution: NA; SA; E; A; AS; CR. Costa Rica: USJ 21360, 8-X-79; I (2) 1,852 m.; JCV 203-79, 28-XII-79; II (2) 2,145 m.

Comments: The collections are first ones for Costa Rica and have been reported elsewhere (Carranza, 1982). It is commonly found together with P. arcularius to which it is similar, the differences being the smaller size of the pores and the darker color of the pileus.

18.* Polyporus diabolicus Berk., Hook. J. Bot. Kew Misc. 8:174, 1856.
Polyporus vernicosus Berk., Hook. J. Bot. Kew Misc. 8:175, 1856.

Distribution: NA; SA; CA; CR. Costa Rica: This species was collected by Rowlee (1924) under #566 in Cartago. A year later, Standley collected it in La Chonta, San Jose. Duplicates are placed in the Herbarium of the College of Forestry, Syracuse, N.Y. and in USJ under #21386. The authors have not found it as yet.

19.* Polyporus elegans Bull. : Fr., Epicr. Syst. Myc., p. 440, 1836-1838.
Boletus elegans Bull., Herb. France, 1784; Boletus nummularius Bull., Herb. France, 1782.

Distribution: NA; E; AS; CR. Costa Rica: TU 7548; USJ 21388; 9-XII-79; VII (1) 200 m. Reported also from Australasia, Samoa (Cunningham, 1965).

Comments: Specimen is sterile but otherwise typical.
Habitat: On dead branches, not on stumps or logs.

20.* Polyporus guianensis Mont., Ann. Sci. Nat. Bot II, 13:201, 1840.
Polyporus Wrightii Murr., N. Amer. Flora 9:61, 1907.

Distribution: SA; CB; CR. Costa Rica: USJ 21470, 8-II-80; VI (1) 1,330m.

Comments: It is listed by Covington (1980) under TU 7239 and TU 516, collected in Turrialba, near Reventazon River at 525 m. A duplicate is in USJ under #31391.

21.* Polyporus maculosus Murr., Torrey Bot. Club Bull. 31: 41, 1904.

Distribution: CA; CR.

Comments: Murrill in his article on North American Polypores (1904), reported this species. No duplicate is in USJ.

22.* Polyporus picipes Fries, Epicr. Syst. Mycol. p.440, 1836-1838.

Distribution: NA; A; E; AS; CR. Costa Rica: USJ 21501, 2-VII-80; I (1) 2,048 m.; C 33, 24-VI-78; I (8) 500 m. (TU 9437). Reported also from Australia (Cunningham, 1965).

Comments: There are decided differences in many respects between our collection and the one of TU 9437 (USJ 21428). Our identification was confirmed by J.L. Lowe and its description agrees with Overholts (1953). The main characteristics are: sporophore reddish brown, stipitate, pileus circular or subcircular, thin, infundibuliform, context pale brown in dry specimens. Pore surface tan grayish. TU 9437 specimen has sporophore light brown, substipitate, pileus subcircular and thicker than our specimens; no spores were found.

23. Polyporus subzonalis Cooke, Grevillea 19:44, 1890.

Distribution: CR.

Comments: There is only one record of this species of which a sample has been placed at SUNNY, College of Forestry Herbarium, collected by Standley and Weir in Limon, Costa Rica.

24.* Polyporus Tricholoma Mont., Ann. Sci. Nat. Bot. II, 8: 365, 1837.
Polyporus raphanipes Wakef., Bull. Misc. Inf. Kew 1914: 157, 1914.

Distribution: NA; A; SA; CB; CA; CR. Costa Rica: USJ 21381, 10-XI-79; VII (2) 86 m.; USJ 21383, 10-XI-79; I (5) 150 m.; USJ 21459, 10-XI-79; VII (3) 144 m.; USJ 21380, 21-XI-79; I (6) 840 m.; USJ 21462, 13-XI-80; I (6) 840 m.; USJ 21384, 14-XI-79; VII (6) 29 m.; JCV 131-80, 7-III-80; V (1) sea level; USJ 21461, 3-IX-80; III (4) 1,057 m.; USJ 21463, 10-X-80; V (7) sea level; TU 9073.

Comments: A common species with distribution between 0-1,100 m. It Agrees with Overholts' description, except the sporophore stipitate, yellowish white, flexible when fresh; pileus circular, umbilicate, 0.5-4.0 cm. Margin typically ciliate. Spores smooth, hyaline, 7 x 2 µ. Habitat: On dead wood in shady wet places, especially in lowlands.

25.* Polyporus virgatus Berk. & Curt., Linn. Soc. Bot. Jour. 10:304, 1868.

Distribution: CB; A; CR.

Comments: The only record known for Costa Rica is that mentioned by Murrill (1915). The same author indicates that collections were also made in Cuba. No duplicate is in USJ.

26.* Pycnoporus sanguineus (L. : Fr.) Murr., Bull. Torrey Club 31:421, 1904.
Polyporus sanguineus L. : Fr., Syst. Myc. 1:371, 1821.

Distribution: NA; SA; CB; A; AS; CA; CR. Costa Rica: USJ 21432, 25-VII-79; I (9) 1,615 m.; USJ 21431, 10-XI-79; VII (3) 144 m.; USJ 21429, 10-XI-79; VII (2) 86 m.; USJ 21433, 10-XI-79; VII (4) 80 m.; USJ 21430, 11-XI-79; I (12) 25 m.; USJ 21439, 9-II-80, VI (1) 1,330 m.; JCV 31-80, 31-I-80; VI (3) 26 m.; USJ 21471, 7-III-80; V (9) 15 m.; USJ 21435, 7-III-80; V (4) 62 m.; USJ 21472, 7-III-80; V (1) sea level; USJ 21442, 4-I-80, VI (4) sea level; USJ 21444, 4-III-80; III (3) 428 m.; USJ 21447, 26-IX-80; VI (6) sea level; JCV 23-80, 4-III-80; VI (5) sea level; USJ 21473, 19-VII-80; VII (7) 564 m.; USJ 21440, 9-X-80; III (4) 1,057 m.; USJ 21441, 10-X-80; V (2) sea level; USJ 21446, 10-X-80; V (6) sea level; USJ 21437, 10-X-80; V (3) 30 m.; USJ 21434, 13-III-81; III (5) 1,040 m.; USJ 21445, 7-III-80; V (5) 62 m.; USJ 21438, 4-IV-80; VI (5) 7 m.; JCV 36-80, 4-X-80; II (1) 646 m.; TU 8191; R 545; C 29.

Comments: It is one of the most widely distributed species in the country, especially in the lowlands, although it ranges from sea level to 1,600 m. Old specimens fade from light orange to almost white. It invades almost any kind of wood in both exposed and shady places.

27.* Rigidoporus microporus (Sw. : Fr.) Overeem, Icon. Fung. Malayensum 5:1, 1924.
Polyporus microporus Swartz : Fries, Syst. Myc. 1: 376, 1821.

Distribution: NA; SA; A; AS; CB; CR. Costa Rica: USJ 21423, 25-VI-79; VI (2) 208 m.; USJ 21278, 30-VIII-79; II (5) 1,050 m.; USJ 21258, 30-VIII-79; II (4) 1,445 m.; JCV 30-79, 30-VIII-79; II (4) 1,445 m.; USJ 21280, 7-IX-79; II (1) 646 m.; USJ 21474, 5-II-80; VI (7) sea level; USJ 21499, 5-X-80; II (1) 646 m.; USJ 21424, 7-III-80; V (9) 15 m.; USJ 21468, 7-III-80; V (1) 20 m.; USJ 21477, 7-III-80; V (4) 62 m.; USJ 21465, 7-III-80; V (5) 62 m.; USJ 21475, 7-III-80; V (1) 3 m.; USJ 21425, 4-III-80; III (1) 428 m.; USJ 21426, 12-VII-80; VII (7) 534 m.; USJ 21476, 8-VIII-80; VI (4) sea level; USJ 21279, 20-IX-80; VII (5) 150 m.; USJ 21206, 26-IX-80; I (13) 25 m.; TU 9036.

Comments: A tropical species very common in our country. Our collections show a bright orange color on the pore surface when fresh, fading on drying. The sporophores become hard and rigid on drying. Habitat: Mainly found on shady places, invading different kinds of wood.

28.* Trametes versicolor (Fr.) Pilát., Atl. Champ. Eur. 3:261, 1939.
Polyporus versicolor L.: Fr., Syst. Myc. 1:368, 1821.

Distribution: NA; SA; CB; A; AS; E; CR. Costa Rica: USJ 21122, 26-X-79; IV (1) 1,530 m.; USJ 21456, 11-XI-79; IV (4) 1,804 m.; USJ 21121, 18-XI-79; I (3) 2,020 m.; USJ 21115, 24-XI-79; I (1) 2,048 m.; JCV 200-79, 28-XII-79; II (2) 2,145 m.; USJ 21123, 8-IV-81; I (5) 1,235 m.; USJ 21119, 18-XI-79; I (3) 2,221 m.

Comments: Covington (1980) listed the species. It is also deposited at TU under 7813. It agrees with Overholts' description except the pileus 1-9 x 1-7 cm, always zonate with darker zones than those specimens used for comparison from U.S.A. Some specimens appear to be substipitate. This species is recognized as one of the most important delignifying fungi of the sap and heartwood of dead and living trees. Habitat: On logs and fence posts.

29.* Trichaptum biformis (Fr. in Kl.) Ryv., Norw. J. Bot. 19:237, 1972.
Trichaptum pargamenum (Fr.) G.H. Cunn., New Zeal. Dpt. Scient. I. R. Bull. 164, 1965; Polyporus pergamenus Fries, Epicr. Syst. Myc. 480, 1836-1838; Coriolus pargamenus (Fr.) Pat., Essai Tax. Hymen. 94, 1900; Polyporus elongatus Berk., Hook. London Jour. Bot. 1:149, 1842.

Distribution: NA; A; AS; E; CB; CR. Costa Rica: USJ 21484, 6-VI-80; I (3) 2,021 m.; USJ 9827 (Lowe #13416). Also reported from Australasia, Oceania and South America.

Comments: There are three additional collections of this species; one made by Rowlee #566, collected in 1924 in Cartago at Volcan Irazu as *Coriolus prolificans* (Fries) Murr.; and the other collections were made by Standley in 1925, near Santa Maria de Dota, San Jose, both as *Polyporus elongatus* Berk. Duplicates of both collections are in the Herbarium of College of Forestry, Syracuse, N.Y. and in USJ under #21389. It is one of the commonest species in North America, but not in the tropics. The pileus in old specimens may become covered with green algae. There is a strong tendency of the pores to become irpiciform, showing also a slight violet tint. The wood decay is a white rot.

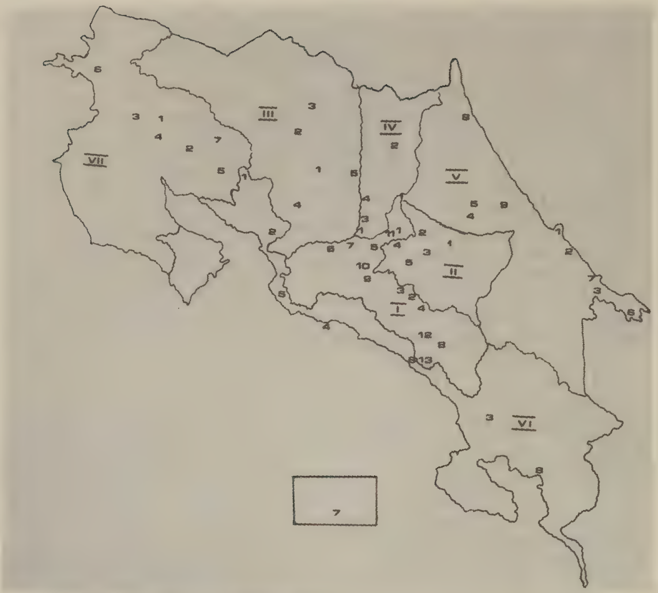
30. *Trichaptum byssogenus* (Jungh.) Ryv., Norw. J. Bot. 19: 237, 1972.
    Polyporus byssogenus Jungh., Verh. Batav. Genootsch. 17:43, 1838; *Trametes versatilis* Berk., Hook. Lond. J. Bot. 1:150, 1842; *Polyporus versatilis* (Berk.) Rom. Svenska Vet. Akad. Bihang till Handl. 26, Afd. III, no. 16:35, 1901.

Distribution: NA; CA; A; AS; CR. Costa Rica: USJ 21452, 7-XII-79; V (8) sea level; USJ 21453, 10-XI-79; VII (2) 86 m.; USJ 21492, 4-I-80; VI (4) sea level; USJ 21491, 19-IX-80; VII (7) 564 m.; USJ 21498, 26-IX-80; I (13) 25 m.; USJ 21454, 10-X-80; V (7) sea level; USJ 21455, 8-V-81; III-(2) 1,025 m.; USJ 21464, 20-IX-80; VII (5) 150 m.; JCV 31-81, 5-IX-81; VI (2) 208 m.

Comments: A very common species on the wet warm lowlands of the country. Sporophores effused-reflexed. Pileus mostly semicircular, confluent laterally, 1-5 x 1-5 cm, zonate. The pileus in old specimens often covered with green algae. Habitat: On exposed logs in open places and on bridge wood; it was also found on burned wood. Apparently causes a white rot.

31. *Trichaptum perrottetii* (Lév.) Ryv., Norw. J. Bot. 19: 229-239, 1972.
    Trametes perrottetii Lév., 1844; *Polyporus trichomallus* Berk. & Mont., Ann. Sci. Nat. Bot. III, II:238, 1849; *Trichaptum trichomallum* (Berk. & Mont.) Murr., Bull. Torrey Club 31:608, 1904; *Funalia trichomalla* Pat., Tax. Hymén. 95, 1900.

Distribution: NA; SA; CB; A; CA; CR. Costa Rica: USJ 21495, 7-IX-79; II (1) 646 m.



I. San Jose:
1. Rancho Redondo
2. Empalme
3. Jardin de Dota
4. Carretera Interamericana Sur
5. San Pedro. Universidad de Costa Rica
6. Ciudad Colon
7. Alto de las Palomas
8. San Isidro del General
9. Frailes
10. Tarbaca
11. San Isidro de Coronado
12. Saavegre
13. Baru

II. Cartago:
1. Turrialba
2. Irazu
3. Cervantes
4. Ochomogo. Bosque Arreas
5. Palomo

III. Alajuela:
1. San Carlos
2. Boca Arenal
3. Buenos Aires
4. San Ramon
5. San Miguel

IV. Heredia:
1. San Rafael. Bosque Rio La Hoja
2. Puerto Viejo
3. Vara Blanca. Los Cartagos
4. Volcan Barva

V. Limon:
1. Limon
2. Westfalia
3. Bribri
4. Guayacan
5. Siquirres
6. Sixaola
7. Cahuita
8. Tortuguero
9. Bataan

VI. Puntarenas:
1. Monte Verde
2. Esparza
3. Palmar Sur
4. Isla Damas
5. Tivives
6. Hatillo
7. Isla del Coco
8. Golfito

VII. Guanacaste:
1. Palo Verde
2. Canas
3. Liberia
4. Bagaces
5. Abangares
6. Santa Rosa
7. Tilaran

Comments: Sporophores decurrent, sessile, flexible when fresh, less so on drying, pileus mostly semicircular, effused-reflexed. The hairy portion that spreads out from the pileus is rug like. Pore surface violaceous brown when fresh. Spores hyaline, smooth-walled, oblong-ellipsoid, 3 x 5 μ. Cystidia abundant, incrusted.
Habitat: On living tree on forest.

32. *Tyromyces cerifluus* (Berk. & Curt.) Murr., N. Amer. Fl. 9:33, 1907.
Polyporus cerifluus Berk. & Curt., Grevillea 1:50, 1872; *Polyporus revolutus* Bres., Ann. Mycol. 18:35, 1920.

Distribution: NA; E; A; CR. Costa Rica: USJ 9841, 9843, 9844, 21385; I (2) 1,852 m.; USJ 9842; IV (3) 1,804 m. Collected by J.L. Lowe, 1963.

Comments: This species is described by J.L. Lowe (1975) and L. Ryvarden and Johansen (1980).

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Fig. 1. Different locations where specimens were collected.

REFERENCES

Ainsworth, G.C. et al. 1973. The Fungi, an Advanced Treatise. Volume IV B. A Taxonomic Review with Keys: Basidiomycetes and Lower Fungi. Pp. 504.

Carranza, J. 1982. Polypores New to Costa Rica. Mycotaxon 15:405-408.

Covington, D.J. 1980. Fungi Costaricensis. A checklist of reported species. Thesis. Tulane University. Pp. 129.

Cunningham, G.H. 1965. Polyporaceae of New Zealand. New Zeal. Dpt. Scient. Ind. Res. Bull. 164. Pp. 304.

Guzmán, G. y X. Madrigal. 1967. Notas sobre algunos hongos superiores de Escarcega, Campeche (Mexico). Rev. Soc. Mex. Hist. Nat. 28:23-38.

Guzmán, G. 1971. Especies de Macromicetos citados de Mexico II: Fistulinaceae, Meruliaceae y Polyporaceae. Bol. Soc. Mex. Mic. 5:57-77.

________. 1972. Macromicetos Mexicanos en el Herbario The National Fungus Collections de EUA. Bol. Soc. Bot. Mexico 32:31-55.

________. 1973. Hongos Mexicanos (Macromicetos) en los Herbarios del extranjero II. Especies del Herbario de Farlow de la Universidad de Harvard, USA. Bol. Soc. Mex. Mic. 7:121-127.

________. 1975. Hongos Mexicanos (Macromicetos) en los Herbarios del extranjero III. Bol. Soc. Mex. Mic. 9:85-102.

________. 1977. Algunos macromicetos argentinos y discusiones sobre su distribucion en Mexico. Bol. Soc. Arg. Bot. 18(1-2):183-204.

Hjortstam, K. et al. 1981. Notes on the Aphyllophorales of Spain II. Nova Hedwigia 34:525-538.

____________ and L. Ryvarden. 1982. Aphyllophorales from Northern Thailand. Nord. J. Bot. 2:273-281.

Johansen, I. and L. Ryvarden. 1977. Wood-inhabiting fungi (Aphyllophorales, Homobasidiomycetes) in two Norwegian forest reserves. Meddel Inst. Skogforsk. 33(11):453-478.

Lowe, J.L. 1957. Polyporaceae of North America. The Genus Fomes. SUNY. College of Forestry, Syracuse, N.Y. Techn. Pub. 80. Pp. 97.

________. 1963. A synopsis of Poria and similar fungi from the tropical regions of the world. Mycologia 55(4):453-486.

________. 1966. Polyporaceae of North America. The Genus Poria. SUNY. College of Forestry, Syracuse, N.Y. Techn. Pub. 90. Pp. 183.

________. 1975. Polyporaceae of North America. The Genus Tyromyces. Mycotaxon 2(1):1-82.

________. 1976. On Polyporus sobrius. Kew Bulletin 31 (3):753-754.

Murrill, W.A. 1904a. The Polyporaceae of North America. VI. The Genus Polyporus. Bull. Torrey Bot. Club

___________. 1904b. The Polyporaceae of North America. VII. The Genera _Hexagona_, _Grifola_, _Romellia_, _Coltricia_ and _Coltriciella_. Bull. Torrey Bot. Club 31:325-348.

___________. 1904c. The Polyporaceae of North America. VIII. _Hapalopilus_, _Pycnoporus_ and new monotypic genera. Bull. Torrey Bot. Club 31:415-428.

___________. 1904d. The Polyporaceae of North America. IX. _Inonotus_, _Sesia_, and monotypic genera. Bull. Torrey Bot. Club 31:593-610.

___________. 1905a. The Polyporaceae of North America. XI. A synopsis of the brown pileate species. Bull. Torrey Bot. Club 32:353-371.

___________. 1905b. The Polyporaceae of North America. XII. A synopsis of the white and bright-colored pileate species. Torrey Bot. Club Bull. 32:469-493.

___________. 1906. The Polyporaceae of North America. XIII. The described species of _Bjerkandera_, _Trametes_, and _Coriolus_. Bull. Torrey Bot. Club 32:633-656.

___________. 1908. Additional Phillippine Polyporaceae. Bull. Torrey Bot. Club 35:391-416.

___________. 1912. The Polyporaceae of Mexico. Bull. New York Bot. Garden 8(28):137-153.

___________. 1914. Northern Polypores. New York. Pp. 64.

___________. 1915. Tropical Polypores. New York. Pp. 113.

___________. 1918. Murrill's and Saccardo's names of Polypores compared. New York. Pp. 31.

___________. 1951. Species of Florida Basidiomycetes. Techn. Bull. 478. Agr. Exp. Sta. Gainesville, Fla. Pp. 36.

Overholts, L.O. 1953. The Polyporaceae of the United States, Alaska and Canada. Ann Arbor, The University of Michigan Press. Pp. 466.

Rowlee, S. 1924. A collection of Costa Rican fungi. Mycologia 16:115-121.

Ryvarden, L. 1969. The Genus _Polyporus_ s.str. in Norway NYTT Mag. Bot. 16(2):151-157.

___________. 1971. Studies in the Aphyllophorales of Finnmark, Northern Norway. Rep. Kevo Subartic Res. Stat. 8:148-154.

___________. 1972a. Studies on the Aphyllophorales of the Canary Islands with a note on the Genus _Perenniporia_ Murr. Norw. J. Bot. 19(2):139-144.

___________. 1972b. A critical check list of the Polyporaceae in Tropical East Africa. Norw. J. Bot. 19(3-4): 229-238.

___________. 1973. New Genera in the Polyporaceae. Norw. J. Bot. 20(1):1-5.

___________. 1974. Studies in the Aphyllophorales of the Canary Islands. 2. Some species new to the islands. Cuad. Bot. Canar. 20:3-8.

________________. 1976a. Type studies in the Polyporaceae. 7. Species described by J.M. Berkeley from 1836 to 1843. Kew Bull. 31(1):81-103.

________________. 1976b. The Polyporaceae of North Europe Vol. I. Albatrellus-Incrustoporia. Fungiflora, Oslo, Norway. Pp. 214.

________________. 1977a. Some wood inhabiting Aphyllophoraceous fungi from Nepal. Khumbu Himal. 6/3:379-386.

________________. 1977b. Type studies in the Polyporaceae. 10. Species described by J. M. Berkeley, either alone or with other authors, from 1844 to 1855. Norw. J. Bot. 24:213-230.

________________. 1978a. Studies in the Aphyllophorales of Africa 6. Some species from Eastern Central Africa. Bull. Jard. Bot. Nat. Belg. 48:79-117.

________________. 1978b. The Polyporaceae of North Europe. Vol. II. Inonotus-Tyromyces. Fungiflora, Oslo, Norway. Pp.507.

________________ and I. Johansen. 1980. A preliminary polypore flora of East Africa. Fungiflora, Oslo, Norway. Pp. 636.

________________. 1982. Type studies in the Polyporaceae. 11. Species described by J.F.C. Montagne, either alone or with other authors. Nord. J. Bot. 2: 75-84.

Stevens, F.L. 1927. Fungi from Costa Rica and Panama. Illinois Biological Monographs. Vol. XI, No. 2. University of Illinois, Urbana, Ill. Pp. 255.

Sydow, H. 1925. Fungi in itinere costaricensi collecti. Pars prima. Ann. Mycologici 23:308-429.

________. 1926. Fungi in itinere costaricensi collecti. Pars secunda. Ann. Mycologici 24(5-6):283-294.

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KOORCHALOMA, KOORCHALOMELLA, AND KANANASCUS GEN. NOV.

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The anamorph-genera **Koorchaloma** and **Koorchalomella** are revised. Five anamorph-species are disposed in **Koorchaloma** and one in **Koorchalomella**. Teleomorphs reported for two species of **Koorchaloma** are disposed in **Kananascus** gen. nov. (Sphaeriales).

Subramanian (1953) proposed the anamorph-genus *Koorchaloma* Subram., type sp.: *K. madreeya* Subram., to accommodate a fungus collected on dead culms of *Oryza sativa* near Poonamallee, Tamil Nadu, India. The generic description stressed the following features: "superficial, bright-coloured, setose sporodochia; simple, brown, septate setae; hyaline conidiophores forming a hymenial layer; and one-celled, acrogenous, non-catenate, hyaline conidia bearing a brush-like apical appendage". The genus was augmented with *K. okamurae* Hino & Katumoto (Hino 1962) and *K. okamurae* var. *assamica* Agnih. (Agnihothrudu 1963).

Chona *et al.* (1958) adopted a somewhat similar generic description for their new genus, *Koorchalomella*, (type sp.: *K. oryzae*) for a fungus which was also collected on *Oryza sativa*. However, the conidia of *K. oryzae* were reported to possess membranous appendages at each end and the absence of dark setae from the sporodochium was considered diagnostic for the genus. They treated *Koorchalomella* as distinct from *Koorchaloma* and *Lomachashaka* Subram., by the absence of dark conidiomatal setae or hyaline hairs, and from *Starkeyomyces* Agnih. (now considered a synonym of *Myrothecium* Tode ex Fr.) by the presence of membranous appendages at both ends of the conidia. Kendrick & Carmichael (1973) considered *Koorchalomella*, *Lomachashaka* and *Starkeyomyces* as putative synonyms of *Koorchaloma*. Carmichael *et al*. (1980) considered *Koorchalomella* as well as *Amphitiarospora* Agnih. as putative synonyms of *Koorchaloma*, but regarded *Lomachashaka* and *Starkeyomyces* as putative synonyms of *Myrothecium*. According to Sutton (1977), however, *Amphitiarospora* is a synonym of *Dinemasporium* Lév.

A study of several collections assignable to *Koorchaloma*, *Koorchalomella*, and *Lomachashaka* has now made it possible to elucidate the status of these anamorph-genera. This paper is, however, limited to an account of the members of *Koorchaloma* and *Koorchalomella*; *Lomachashaka* will be discussed in another paper dealing with the taxonomy of *Myrothecium* and allied genera.

One of my collections gathered in Bangalore, India in 1970 comprised decaying culms of *Oryza sativa* from damp ground and bore a *Koorchaloma* sp., a *Koorchalomella* sp., and an ascomycete. The conidiomata of the *Koorchaloma* sp. in this collection appear sporodochial in general appearance, but are actually shallow cupulate in sectional view, exhibiting marked marginal, excipular development composed of 'textura intricata', the elements of which are fused below but free above (Figs. 16, 17, 22a). The conidiomatal setae have a terminal cell that is apically bulbous, thin-walled, subhyaline to hyaline, 8-14 X 8-9.5 µm. Though Subramanian (1953) described the setae as narrowing toward the blunt tip, a few remaining setae on the poorly preserved type specimen of *K. madreeya* exhibited the same morphology as those seen in my collection. I have no hesitation in disposing my collection as *K. madreeya*.

Presence of similar setae on the perithecia of the ascomycete (Fig. 61c) occurring with *K. madreeya* suggested a genetic connection between the two. The viable condition of the collection gave an opportunity to verify the hypothesis. The material was incubated in a moist chamber overnight and agar cultures were initiated with single ascospores and single conidia. Monoconidial and monoascosporic isolates grew well on PDA and yielded sporulating cultures of *K. madreeya* identical with the form seen in nature. Prolonged incubation failed to produce perithecia.

The type specimen of *K. okamurae* and collections of three other species of *Koorchaloma* from Jamaica show discoid to shallow cupulate conidiomata with varying degrees of marginal development (Figs. 1, 8, 23, 29). The conidia of *K. okamurae* occasionally bear mucoid appendages at both ends (Figs. 31, 32, 36d), while the conidia in the three Jamaican collections invariably bear mucoid appendages at both ends (Figs. 4-6, 7d, 12-14, 15d, 26, 27, 28e). One of the Jamaican collections carried a pyrenomycete (Figs. 62-68) that agrees in major morphological features with the teleomorph of of *K. madreeya* but is distinct from it in a few details. Again, monoascosporic agar cultures of this fungus yielded only the *Koorchaloma* anamorph. Failure of the monoascosporic isolates of these two distinct species to produce perithecia in cultures indicates that the pyrenomycete-anamorph complex is possibly heterothallic.

In contrast to the *Koorchaloma* spp. mentioned above, my collection of *Koorchalomella* has superficial, pulvinate, sporodochial conidiomata (Fig. 43) with a flesh-coloured centre and a characteristic white fringe of septate, hyaline, sterile hyphae with somewhat spathulate apices (Figs. 44, 48b), loosely aggregated conidiophores (Fig. 48a), phialides with distinct periclinal thickenings in the collarette zones (Figs. 45, 48c) and hyaline ameroconidia with mucoid appendages at both ends (Figs. 46, 47, 48d). The sporodochia are 200-700 µm long, 100- 420 µm wide and 130-320 µm deep; the sterile hyphae are up to 200 µm long and extend well above the conidial hymenium; conidiophores up to 60 µm long; phialides are 14-22 (-25) X 2.5- 3.5 (-4) µm and conidia 10-19 (-23) X 3-4.5 µm with a mean conidium length/width ratio of 3.8:1; appendages are funnel-shaped, and 3-7 µm long and 2-3 µm wide.

In BPI there is a specimen labelled *Pestalozziella* ? *carnea* E. & E., on decaying culms of wild rice (*Zizania* sp.), Louisiana, III.1887, Langlois. Apparently the binomial *P. carnea* was never published by

Ellis & Everhart. The packet contains two pieces of dried culms of a monocot bearing scattered, superficial, waxy, flesh-coloured sporodochia each with a thin white fringe (Fig. 49), and 300-1100 µm diam by 150- 420 µm deep. The flexuous, septate, hyaline, smooth-walled sterile hyphae are 90-120 µm long, 2-3 µm wide at the base and 3.5-5 µm wide at the slightly spathulate apices (Figs. 52, 56b) and extend slightly above the conidioma. The conidiophores arise in a compact palisade (Figs. 50, 56a), and are branched, septate, hyaline, thin- and smooth-walled, with each branch terminating in a phialide. Phialides are clavate to subcylindrical, hyaline, smooth-walled, and 15-25 (-31) X 2.5-3.5 µm. Ameroconidia (Figs. 51, 56c) are fusiform-elliptic to naviculate, hyaline, thin- and smooth-walled, 13-21 X 3-4 µm, bearing funnel-shaped, mucoid appendages at both ends, and have a mean conidium length/width ratio of 4.6:1.

Rai & Tewari (1961) isolated K. oryzae from soil in Lucknow, India and reported conidial dimensions of 9.6-17.6 X 3.2-4 µm. A poorly preserved dried agar culture (IMI 82629), has been examined. The sporodochial conidiomata bear septate, simple, hyaline, sterile hyphae with spathulate apices (Fig. 55) and conidia typical of a species of Koorchalomella.

The foregoing specimens have been compared with the type specimen of Koorchalomella oryzae in HCIO (Figs. 37-42). The latter is in a very bad state of preservation, but a few intact sporodochia were available for study. The sporodochia conform to the above descriptions except that the characteristic sterile hyphae could not be observed, despite efforts to separate the cohesive elements constituting the sporodochium. Sporodochia are 600-1100 µm diam and 250-450 µm deep; conidiophores are up to 30 µm long; phialides are 9-22 X 2.5-3.5 µm; conidia are (12-) 15-20 X 3.5-4 µm; mean conidium length/width ratio = 4.7:1.

It is clear from the above descriptions that there is considerable overlap in the quantitative features of those collections of *Koorchalomella* studied. The only distinct variation appears to be related to the sterile hyphae: these are indistinct or absent in the type specimen of *K. oryzae*, prominent in my collection, and less distinct in the Langlois collection in BPI. Rather than consider my collection distinct from *K. oryzae*, I prefer to group all three collections under a single species and treat *K. oryzae* as an extremely variable species with the sterile hyphae in the sporodochia exhibiting varying degrees of development or none. When grown on agar media, my collection of *K. oryzae* exhibited the same morphological features as those encountered on the natural substrate.

Koorchaloma and *Koorchalomella* are distinct anamorphs. The distinguishing features of the two are presented in Table 1.

The teleomorphs of *Koorchaloma* cannot be assigned to any known genus of Sphaeriales. I propose, therefore, **KANANASCUS** gen. nov. to accommodate them, the name being derived in part from Kananaskis, Alberta, Canada, the venue of conferences devoted to the synthesis and advancement of our knowledge of conidial fungi and anamorph-teleomorph connections.

Table 1. Distinctive morphological features of species of *Koorchaloma* and *Koorchalomella oryzae*.

Morphological features.	*Koorchaloma* spp.	*Koorchalomella oryzae*.
Conidiomata.	Acervuloid to shallow cupulate, excipulate, setose.	Sporodochial with or without sterile hyphae.
Excipulum.	Marginal, with varying degrees of development.	Absent.
Setae.	Dark-coloured and thick-walled below, progressively lighter and thin-walled toward apices.	Absent.
Sterile hyphae.	Absent.	Hyaline, septate, with spathulate apices.
Conidiophores.	Mostly reduced to conidiogenous cells.	Lax or closely packed.
Conidium ontogeny.	Phialidic.	Phialidic.
Conidia.	Amero-, naviculate to fusiform.	Amero-, naviculate to fusiform.
Conidium appendages.	Mucoid, only at the apex or at both ends.	Mucoid, at both ends.

Taxonomic part

KOORCHALOMA Subramanian
J. Ind. bot. Soc. 32: 124, 1953.

Caulicolous to foliicolous. Conidiomata stromatic, sporodochioid to acervular with varying degrees of excipular development, superficial, scattered to gregarious and often confluent, gelatinous or not, bright coloured, setose; basal stroma of 'textura angularis', cells thick-walled and brown to subhyaline or hyaline; excipulum of 'textura intricata' only or of 'textura oblita' in the outer layers merging with an inner 'textura intricata'; setae interspersed throughout the conidioma, simple, erect or variously bent, cylindrical to terete or subulate, multiseptate, dark brown to black in the basal part, lighter above, apical cell often inflated and showing percurrent growth. Conidiophores branched and septate or often reduced to conidiogenous cells, hyaline, smooth-walled, invested in mucus. Conidiogenous cells phialides with variable degrees of periclinal thickening of the collarette zone, ampulliform to lageniform or clavate, hyaline, smooth-walled, without percurrent proliferations. Conidia blastic-phialidic, fusiform to naviculate, unicellular, hyaline, thin- and smooth-walled, bearing a mucoid, funnel-shaped appendage at the apex alone or at each end; appendage formed by splitting of the conidium sheath or by the eversion of a partial conidium sheath on the developing conidium.

Type anamorph-species: **Koorchaloma madreeya** Subramanian.
Teleomorph: **Kananascus** Nag Raj.

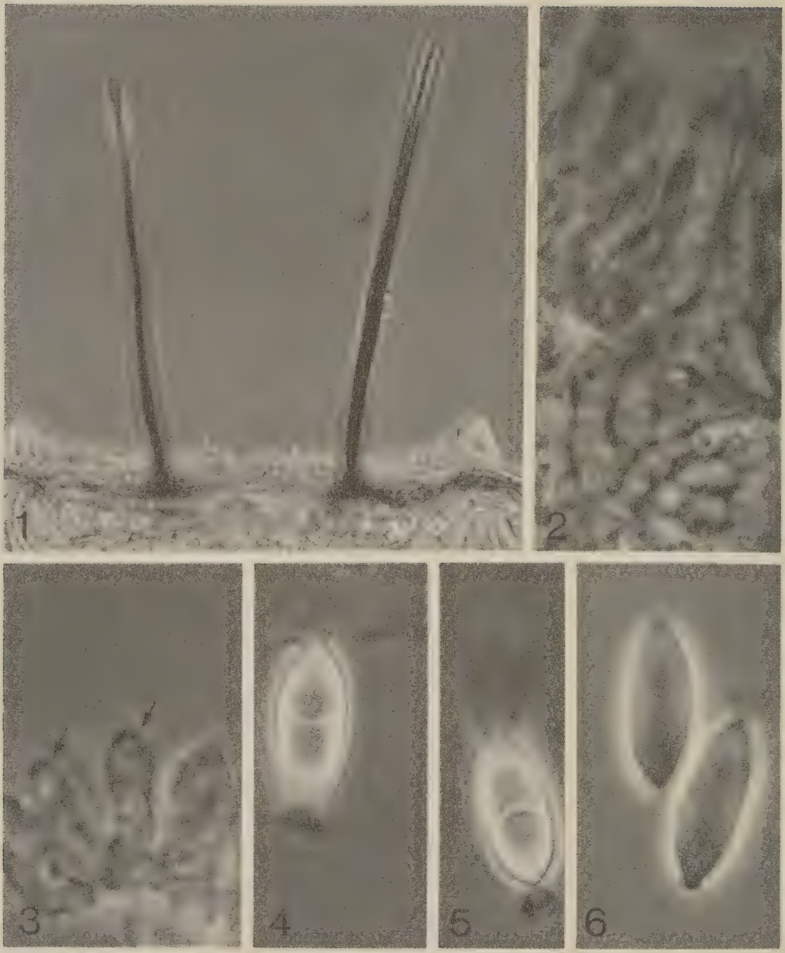
KEY TO SPECIES OF **KOORCHALOMA**

A. Conidioma not gelatinous; periclinal thickening of the collarettes prominent; conidia bearing mucoid appendage usually at the apex only............................B
A. Conidioma gelatinous; periclinal thickening of the collarettes less marked; conidia bearing mucoid appendages at both ends.....C
B. Mean conidium length/width ratio = 2.8 :1 ....**K. okamurae**
B. Mean conidium length/width ratio = 3.7 :1..............................**K. madreeya**
C. Conidia fusiform; mean conidium length/width

ratio = 2.7:1.................... **K.bambusae**
C. Conidia naviculate; length/width ratio > 2.7:1...D
D. Marginal excipulum conspicuous; conidium length/width ratio= 5.3:1....**K. jamaicense**
D. Marginal excipulum less marked; conidium length/width ratio= 3.9:1..**K. occidentalis**

1. **Koorchaloma bambusae** anam.-sp. nov.
Figs. 1-7

Caulicola et foliicola. Conidiomata stromatica, cupulata, vadosa, ubi foliicola amphigena, dissita vel gregaria et plerumque confluentia, superficialia, velut pulvinatas, gelatinosas, ubi aridas luteolas ad fulvas, ubi udas albidas crustas perceptibilia, ambitu orbiculari et ovali, subinde lineari, 120-250 µm long., usque ad 100 µm lat., et 30-35 µm alt. (sine massa conidiorum), setosa; cum tenui, basali textura angulari ex cellularum atro-brunneis, crassitunicatibus; excipulo redacto; externe textura oblita interne in textura intricata commiscentibus. Setae conidiomati penitus interspersae, rectae vel varie curvae, simplices, cylindraceae vel teretes, basibus et apicibus parum sufflatis, 5-8-septatae, in pars superiora septiis tenuibus et indistinctis, in pars inferiora atrobrunneis, cum tunica crasso et laevi, sursum progressive pallescenti et tenuiascenti, 80-160 ($\bar{x}$= 125) µm long., basim 7-9 µm lat., apicem 3-5.5 ($\bar{x}$= 4) µm lat.; cellula terminalis pallide brunnea vel subhyalina, cum tunica tenui interdum percurrenter crescens. Conidiophora cellulis conidiogenae redacta. Cellulae conidiogenae phialides, ampulliformes vel lageniformes, hyalinae, laeviae, 6-11 X 2.5-3.5 (-4) ($\bar{x}$= 8 X 3) µm, cum collulis apicalibus minutis vel indistinctis. Conidia blastico-phialidica, amerosporacea, fusiformia, apice apiculato et base anguste truncato, hyalina, laevia, guttulata, 9-13 X 3.5-5 ($\bar{x}$=



Figures 1-6. **Koorchaloma bambusae** ex type in DAOM 187208. Fig. 1. Vertical section of a conidioma. X 352. Fig. 2. Elements of marginal excipulum. X 2000. Fig. 3. Phialides (periclinal thickenings are indicated by arrows). X 2000. Figs. 4 & 5. Mature conidia from aqueous mount. X 2000. Fig. 6. Mature conidia from lactic acid mount. X 2000. (All phase contrast).

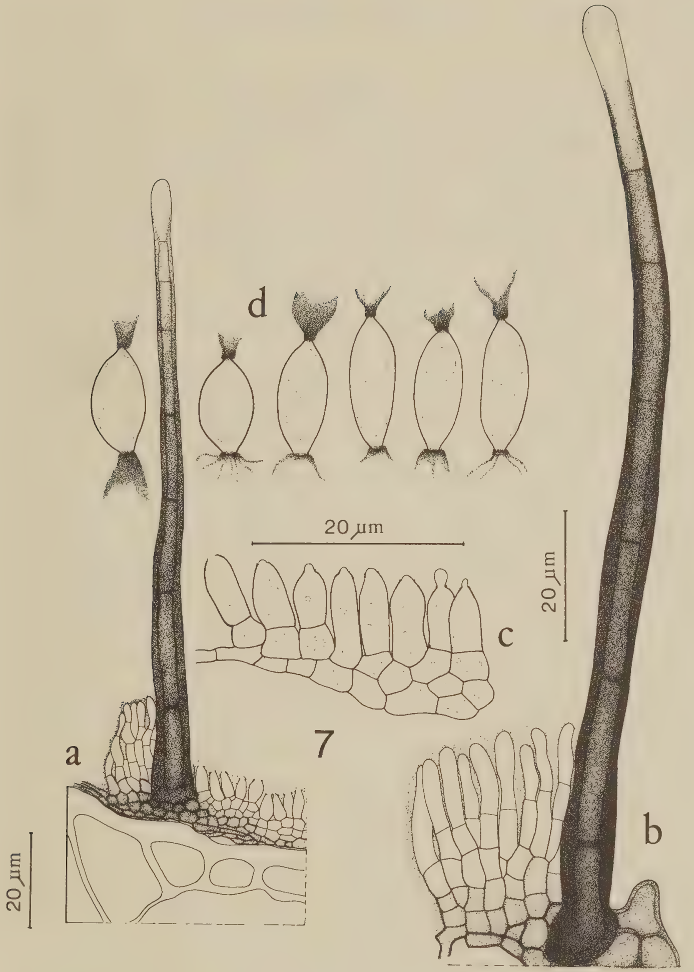

d
20 µm
20 µm
c
7
a
b
20 µm

Figure 7. **Koorchaloma bambusae** ex type in DAOM 187208. a & b. Parts of sectional view of conidioma to show the thin basal stroma, marginal excipulum, and a seta. c. Phialides. d. Mature conidia.

11.4 X 4.2) µm, utrinque appendices mucosas ferentia.

Caulicolous and foliicolous. Conidiomata stromatic, shallow cupulate, amphigenous when foliicolous, scattered to gregarious and often confluent, superficial, appearing as pulvinate, gelatinous, flat crusts, off-white when moist, dirty yellow to brownish yellow when dry, orbicular to oval in outline, occasionally linear, 120-250 µm long, up to 100 µm wide and 30-35 µm high (without the conidial mass), setose; with a thin, basal 'textura angularis' of dark brown, thick-walled cells and a reduced excipulum of 'textura oblita' in the outer layers merging into a 'textura intricata' in the inner layers. Setae interspersed throughout the conidiomata, simple, erect or variously bent, cylindrical or terete with slightly inflated base and apex, 5-8-septate, septa thin and indistinct in the upper part, dark brown, thick- and smooth-walled in the lower part, becoming progressively lighter coloured, thin- and smooth-walled above, with the terminal cell thin-walled, pale brown to subhyaline, 80-160 ($\bar{x}$=125) µm long, 7-9 µm wide at the base, 3-5.5 ($\bar{x}$=4) µm wide at the apex, with occasional percurrent growth. Conidiophores reduced to conidiogenous cells, invested in mucus. Conidiogenous cells phialides, ampulliform to lageniform, hyaline, smooth-walled, 6-11 X 2.5-3.5 (-4) ($\bar{x}$= 8 X 3) µm, with minute, indistinct apical thickenings. Conidia blastic-phialidic, fusiform with an apiculate apex and a narrow truncate base, unicellular, hyaline, smooth-walled, guttulate, 9-13 X 3.5-5 ($\bar{x}$= 11.4 X 4.2) µm, bearing apical and basal mucoid appendages, mean conidium length/width ratio = 2.7:1.

Habitat: On dead leaves and culms of Bambusa sp.

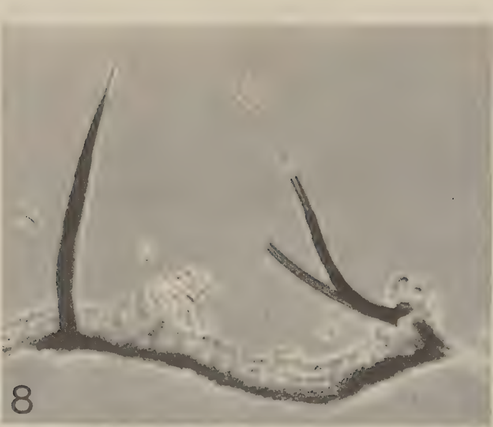
Specimens examined: 1. DAOM 187208 (HOLOTYPE), Maggotty, Jamaica, W.I., 30.V.1978, T.R. Nag Raj; 2. DAOM 187209, Martha Brae River Bank, Jamaica, W.I., 31.V.1978, T.R. Nag Raj.

Known distribution: West Indies.

Teleomorph: Unknown.

2. **Koorchaloma jamaicense** anam.-sp. nov. Figs. 8-15.

Foliicola. Conidiomata stromatica, cupulata, non profunda, amphigena, dissita vel gregaria et aliquando confluentia, superficialia, velut pulvinatas, gelatinosas, salmoneas vel carneas crustas perceptibilia, ambitu orbiculari vel irregulari, 120-320 µm diam, 30-50 µm alt. (sine massa conidiorum), setosa; stroma basale tenue ex textura angulari basi e cellulis atrobrunneis vel brunneis, crassitunicatibus, insuper cellulis hyalinis commiscentibus; excipulo redacto, externe textura oblita interne in textura intricata commiscentibus; setae conidiomati marginales et irregulatim interspersae, simplices, rectae vel varie curvae, subulatae ad subcylindraceae, pluriseptatae, septiis persaepe indistinctae, in pars inferiora atrobrunneae ad nigrae, sursum pallescentes, 80-170 µm long., basim 13-15 µm lat., et admodum infra cellulam terminalem 3-7 µm lat.; cellula terminalis leniter bulbosa, subhyalina, cum tunica tenui, interdum percurrenter crescens. Conidiophora cellulis conidiogena redacta, in muco involuta. Cellulae conidiogenae phialides, ampulliformes vel lageniformes, hyalinae, laeviae, 6-11 (-12) X 2.5-3 µm, cum collulis apicalis minutis praeditae. Conidia blastico-phialidica, amerosporacea, naviculata, interdum fusiformia, apice obtuso et base anguste truncato, saepe



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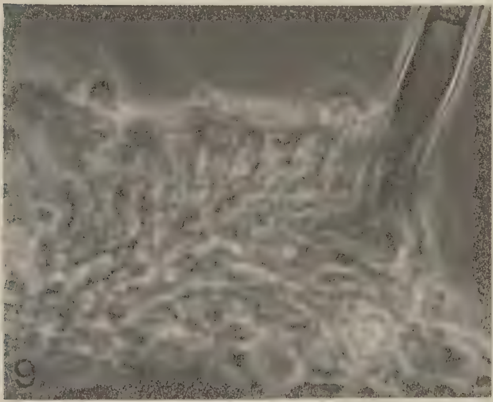

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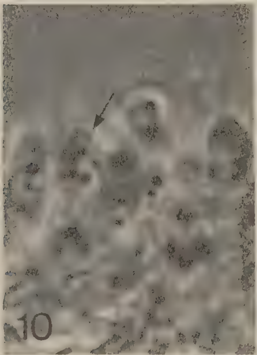

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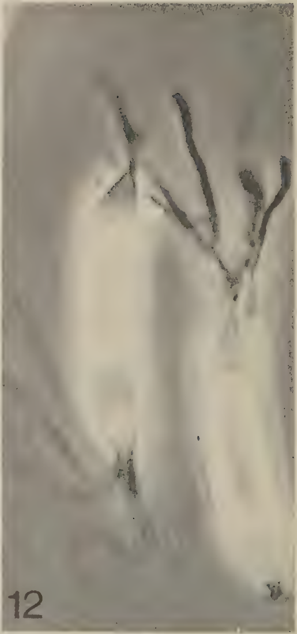

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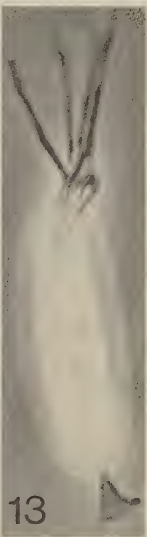

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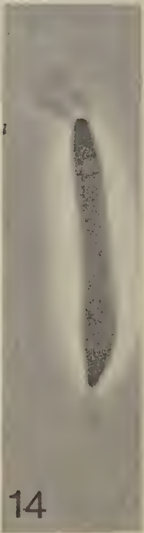

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Figures 8-14. **Koorchaloma jamaicense** ex type in DAOM 187210. Fig.8. Vertical section of a conidioma. X 260. Fig. 9. Partial, enlarged view of a vertical section of a conidioma showing basal stroma, part of a seta and excipular elements. X 1200. Figs. 10 & 11. Phialides (periclinal thickenings marked by arrow). X 2000. Figs. 12 & 13. Mature conidia from aqueous mounts. X 2000. Fig. 14. Mature conidium from lactic acid mount. X 2000. (All phase contrast).

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utrinque apiculato, hyalina, laevia, guttulata, 12-19 X 2.5-3.5 ($\bar{x}$= 16 X 3) µm, utrinque appendices mucosas ferentia; appendicibus primo infundibuliformibus, deinde in pluribus radiantibus filiis findentibus.

Foliicolous. Conidiomata stromatic, shallow cupulate, amphigenous, scattered to gregarious and occasionally confluent, superficial appearing as pulvinate, gelatinous, salmon to flesh coloured crusts, orbicular to irregular in outline, 120-320 µm diam, 30-50 µm deep (excluding the conidial mass), setose; basal stroma thin, of 'textura angularis', with dark brown to brown, thick-walled cells in the basal layers, merging with hyaline cells above; excipulum reduced, of 'textura oblita' in the outer layers merging into a 'textura intricata' in the inner layers; setae marginal and irregularly interspersed, simple, erect or variously bent, subulate to subcylindrical, many- septate, often with obscure septa, dark brown to black and thick-walled in the basal part, lighter and with thinner walls above, 80-170 µm long, 13-15 µm wide at the base and 3-7 µm wide below the terminal cell; terminal cell somewhat bulbous, subhyaline, thin-walled, with occasional percurrent growth. Conidiophores reduced to conidiogenous cells arising from the upper layer of cells of the basal stroma, invested in mucus. Conidiogenous cells phialides, ampulliform to lageniform, hyaline, smooth-walled, 6-11 (-12) X 2.5-3 µm,

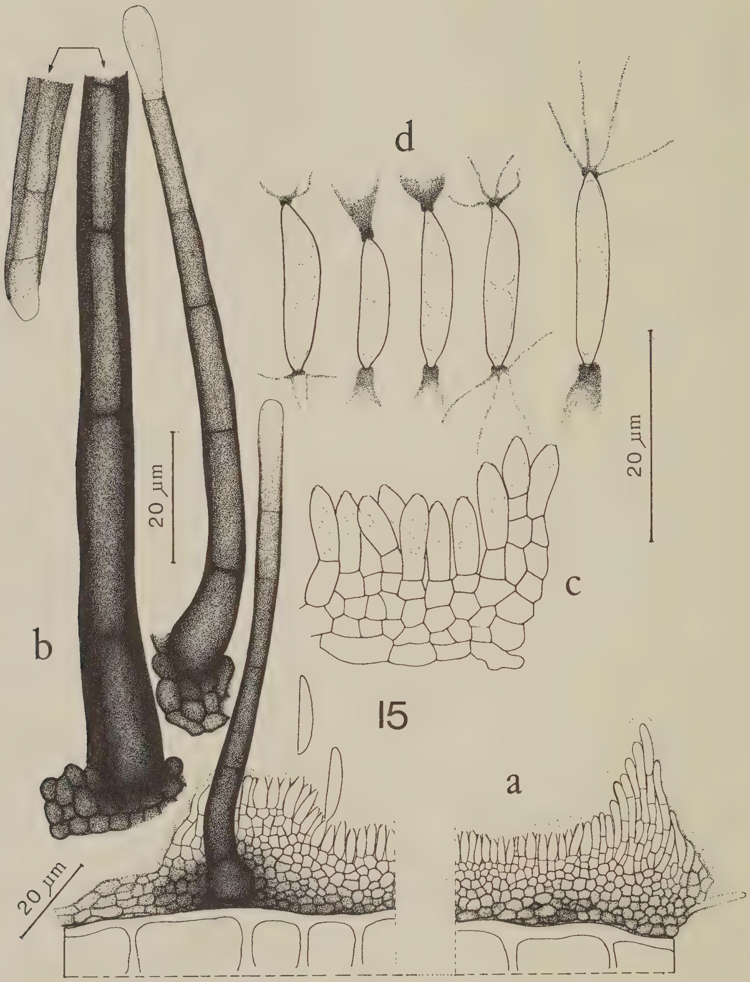

d
20 µm
20 µm
c
b
15
a
20 µm

Figure 15. **Koorchaloma jamaicense** ex type in DAOM 187210. a. Sectional view of a conidioma. b. Setae. c. Phialides. d. Mature conidia.

with minute, apical collarettes. Conidia blastic-phialidic, naviculate, occasionally fusiform with an obtuse apex and a narrow truncate base, often apiculate at both ends, unicellular, hyaline, smooth-walled, guttulate, 12-19 X 2.5-3.5 ($\bar{x}$= 16 X 3) µm, bearing apical and basal mucoid appendages; appendages initially funnel-shaped, then splitting into several radiating strands of mucoid material; mean conidium length/width ratio= 5.3:1.

Habitat: On grass blades.

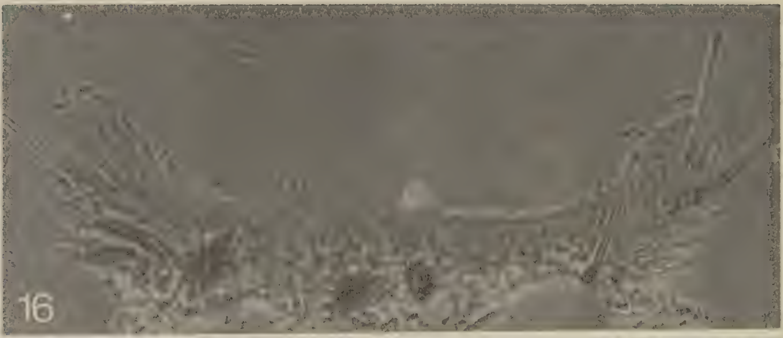
Specimen examined: 1. DAOM 187210 (Type), Seawind Beach Resort area, Montego Bay, Jamaica, W.I.,27.V.1978, T.R.Nag Raj; 2. IMI 76445, Hope, Jamaica, XI.1924, C.G.Hansford (494), in association with a Myrothecium-like anamorph.

Known distribution: Jamaica (West Indies).

Teleomorph: **Kananascus verrucisporus** Nag Raj.

3. **Koorchaloma madreeya** Subramanian
J. Ind. Bot. Soc. 32: 126, 1953.
Figs. 16-22.

Caulicolous and foliicolous. Conidiomata stromatic, appearing sporodochioid and pulvinate but shallow cupulate in sectional view, amphigenous, scattered to gregarious and occasionally confluent, superficial, salmon to orange-coloured, orbicular to irregular in outline, 200-600 µm diam, 60-200 µm deep, up to 1200 µm diam when confluent, setose; basal stroma thin, of 'textura angularis', cells thick-walled, hyaline; excipulum moderately developed, of 'textura intricata', elements hyphoid, intertwined, septate, branched, hyaline, thin- and smooth-walled in the inner layers but somewhat thick-walled in the outer layers; setae interspersed throughout the conidioma, simple, erect or variously bent, cylindrical to subcylindrical, multiseptate,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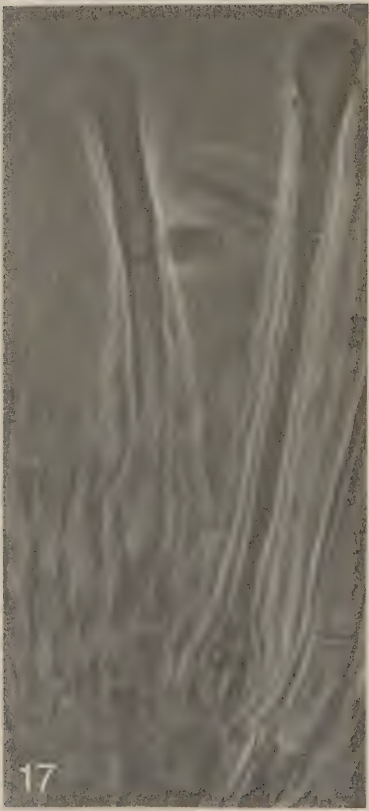
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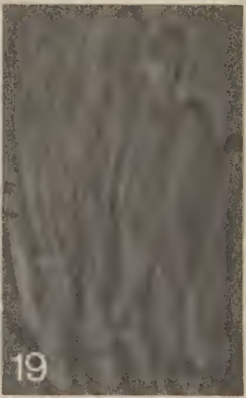
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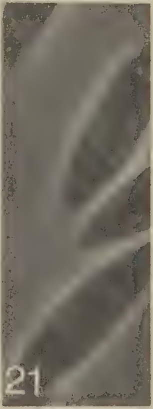
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Figures 16-21. **Koorchaloma madreeya** ex DAOM 187211. Fig. 16. Vertical section of a conidioma. ca X 192. Fig. 17. Excipular elements and setae. X 2000. Figs. 18 & 19. Phialides. X 2000. Fig. 20. Mature conidia from aqueous mount. X 2000. Fig. 21. Mature conidia from lactic acid mounts. X 2000. (All phase contrast).

dark brown, thick- and smooth-walled below, becoming progressively lighter and thin-walled toward the apex, 100-350 µm long, 8-12 µm wide at the base, 4-6 µm wide below the apical cell; apical cell bulbous, thin-walled, subhyaline to hyaline, 8-14 X 8-9.5 µm, with occasional percurrent growth. Conidiophores arising from the basal stroma, branched, septate, hyaline, smooth-walled, invested in mucus. Conidiogenous cells phialides, subcylindrical to obclavate with distinct flaring collarettes, hyaline, smooth-walled, 11-20 X 3-4 ($\bar{x}$= 15.8 X 3.5) µm. Conidia blastic-phialidic, fusiform with an acute, occasionally apiculate, apex and a narrow truncate base, unicellular, hyaline, smooth-walled, 11-17 X 3-4.5 ($\bar{x}$= 14 X 3.8) µm, bearing a funnel-shaped, mucoid, apical appendage; mean conidium length/ width ratio= 3.7:1.

Habitat: On dead, rotting culms of *Oryza sativa*.

Specimens examined: 1. MUBL 853 (Type), Poonamallee High Road, Chingleput Dist., Tamilnadu, India, 24.II.1953, C.V.Subramanian; 2. DAOM 187211, on decaying straw of *O. sativa*, Rajajinagar, Bangalore, India, 23.VIII.1970, T.R. Nag Raj.

Known distribution: India.

Teleomorph: **Kananascus koorchalomagnatus** Nag Raj.

The fungus can be easily grown on synthetic agar media. On potato-dextrose agar plate cultures incubated at room temperature,

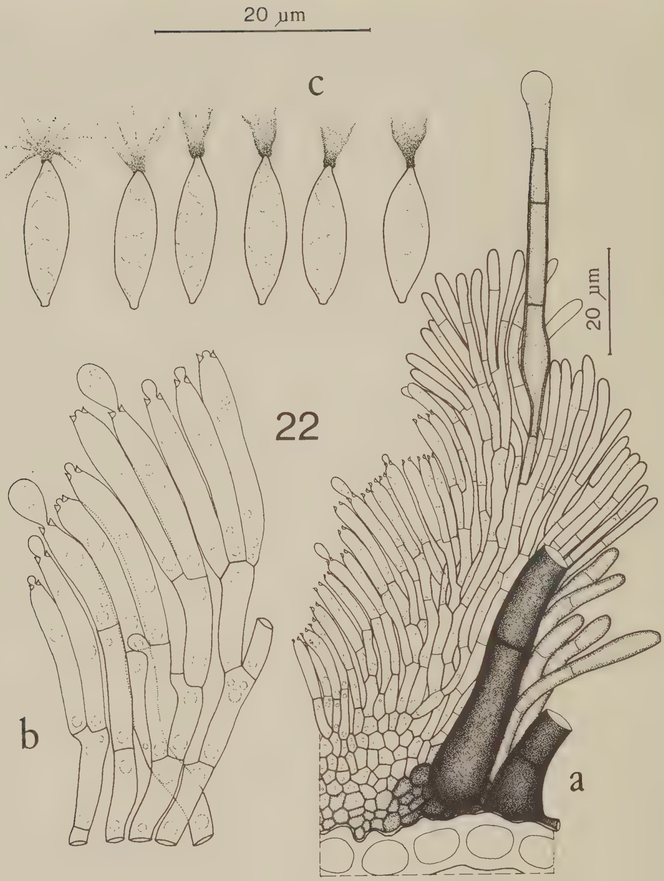

Figure 22. **Koorchaloma madreeya** ex DAOM 187211. a. Basal stroma, excipular elements and setae. b. Conidiophores and phialides. c. Mature conidia.

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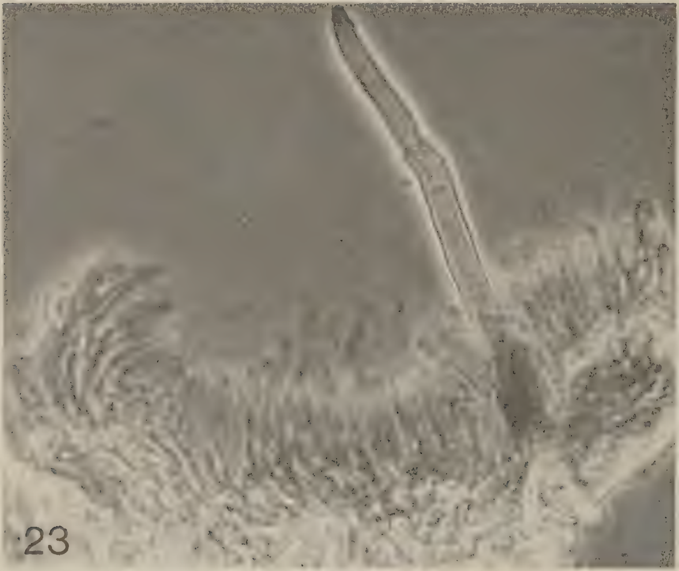
growth is apparent in two days as a dense white, cottony to wooly aerial mycelium, which is somewhat adpressed to the medium and has uneven margins. Reverse is white to creamy yellow. In about 6 days, colonies are effuse, densely cottony, tending to be funiculose; growth is pale pink in the centre; margins are flat and fimbriate and reverse yellowish brown. Initials of conidioma develop as white condensed mycelium in about 8 days and become mature in about 12 days.

Monoascosporic cultures from the pyrenomycete present in the Bangalore collection yielded an anamorph which resembled that seen in nature, but failed to produce perithecia. An account of this teleomorph appears elsewhere in this paper.

4. **Koorchaloma occidentalis** anam.-sp. nov.
Figs. 23-28.

Foliicola. Conidiomata stromatica, cupulata, vadosa, dissita, interdum gregaria et confluentia, superficialia, velut pulvinatas, gelatinosas, flavidas ad glandaceas crustas perceptibilia, ambitu orbiculari vel ovali, 80-180 µm diam, 40-70 µm alt. (sine massa conidiorum), setosa; stroma basale moderate evoluto, ex textura angularis e cellulis hyalinis composita; excipulo bono modo evoluto, strato externe e textura oblita, in strato interne e textura intricata commiscentibus; setae penitus conidiomatis interspersae, simplices, rectae vel varie curvae, subulatae, basibus leniter sufflatis, apicibus acutis, 2-7-septatae, in pars superiora septiis indistinctis, in pars inferiora brunneis, cum tunica crasso et laevi, sursum progressive luteolis, cum tunica tenui et asperati, 35-130 um long., basim 7-11 µm lat., apicem 2.5-3.5 (-4) µm lat., interdum percurrenter crescentes. Conidiophora curta (30-35 µm long.), ramosa, septata, hyalina, in muco involuta. Cellulae conidiogenae phialides, ampulliformes, lageniformes vel



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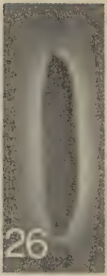

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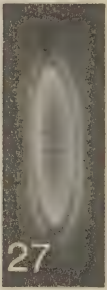

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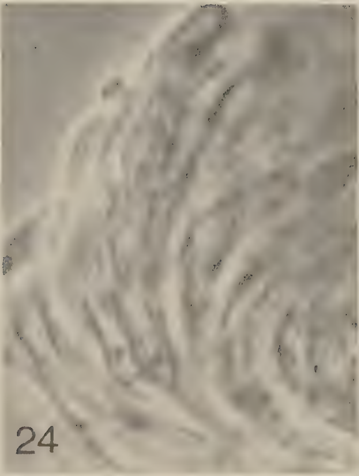

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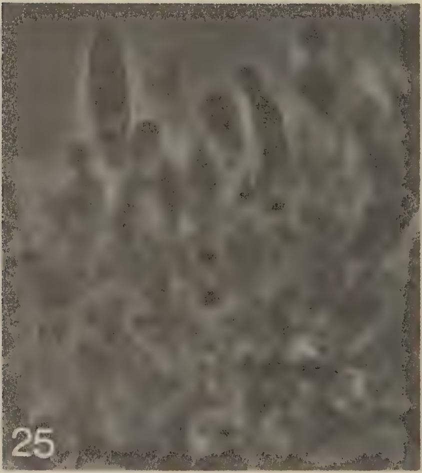

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Figures 23-27. **Koorchaloma occidentalis** ex type in DAOM 187212. Fig. 23. Vertical section of a conidioma. X 64. Fig. 24. Excipular elements. X 2000. Fig. 25. Phialides. X 2000. Fig. 26. A mature conidium from lactic acid mount. X 2000. Fig. 27. A mature conidium from aqueous mount. X 2000. (All phase contrast).

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clavatae, hyalinae, laeviae, 7-15 X 2-3 µm, cum collarulis apicalibus minutis et indistinctis. Conidia blastico-phialidica, amerosporacea, fusiformia vel elliptico-fusiformia, apice acuto, base anguste truncato, saepe apiculato, hyalina, laevia, 9-15 X 2.5-3.5 ($\bar{x}$= 12 X 3) µm, utrinque appendices mucosas ferentia.

Foliicolous. Conidiomata stromatic, shallow cupulate, scattered, occasionally gregarious and confluent, superficial, appearing as pulvinate, gelatinous, yellow to brownish yellow crusts, orbicular to oval in outline, 80-180 µm diam, 40-70 µm deep (excluding the conidial mass), setose; basal stroma moderately developed, of 'textura angularis' of hyaline cells; excipulum moderately developed, of 'textura oblita' in the outer layers merging with 'textura intricata' in the inner layers; setae interspersed throughout the conidioma, simple, erect or variously bent, subulate with slightly bulbous base and an acute apex, 2-7-septate with the septa indistinct in the upper part, brown, thick and smooth-walled in the lower part, becoming pale yellow to subhyaline, thin-walled and asperate at the apex, 35-130 µm long, 7-11 µm wide at the base, 2.5-3.5 (-4) µm wide at the apex, often showing percurrent growth. Conidiophores branched, septate, hyaline, 30-35 µm long, invested in mucus. Conidiogenous cells phialides, ampulliform to lageniform or clavate, hyaline, smooth-walled, 7-15 X 2-3 µm, with minute indistinct collarettes.

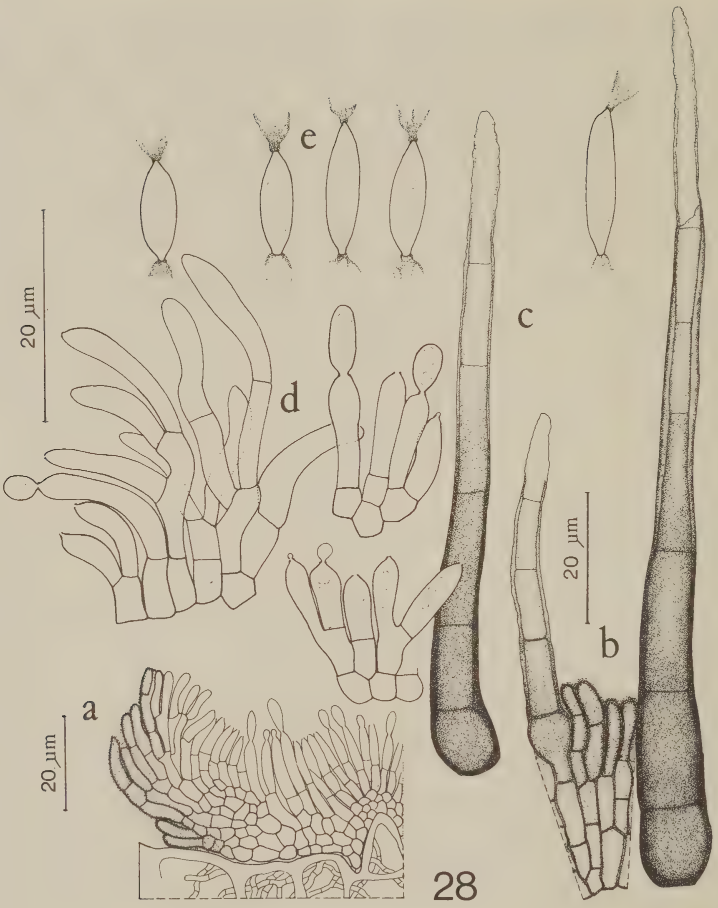

Figure 28. **Koorchaloma occidentalis** ex type in DAOM 187212. a. Basal stroma and excipular elements. b. Excipular elements and a developing seta. c. Seta. d. Excipular elements and phialides. e. Mature conidia.

Conidia blastic-phialidic, fusiform to elliptic-fusiform with an acute apex and a narrow, truncate and often apiculate base, unicellular, hyaline, smooth-walled, 9-15 X 2.5-3.5 ($\bar{x}$= 12 X 3) µm, bearing mucoid appendages at both ends; mean conidium length/ width ratio= 4:1.

Habitat: On grass blades.

Specimen examined: DAOM 187212 (Type), Seawind Beach Resort area, Montego Bay, Jamaica, W.I., 27.V.1978, T.R.Nag Raj (N.Jam. 4).

Known distribution: Jamaica (West Indies).

Teleomorph: Unknown.

5. **Koorchaloma okamurae** Hino & Katumoto in Hino, Icones Fungorum Bambusicolorum Japonicorum: 264, 1961.

Figs. 29-36.

Caulicolous. Conidiomata stromatic, shallow cupulate, scattered to gregarious and rarely confluent, superficial, appearing as pulvinate, salmon or flesh coloured crusts, orbicular to oval in outline, 140-320 µm diam, up to 900 µm diam. when confluent, 35-45 µm deep (excluding the conidial mass), setose; basal stroma well developed, of 'textura angularis', cells hyaline; excipulum well developed, of 'textura intricata' with septate, branched, hyaline, hyphoid elements; setae marginal, simple, cylindrical to subcylindrical, erect or slightly curved, septate, thick-walled, brown to dark brown below, becoming lighter and slightly attenuated toward the apex, smooth-walled, up to 200 µm long, 9-10 µm wide at the base, 5-7 µm wide above. Conidiophores arising from the upper layer of cells of the basal stroma, branched, septate, hyaline, smooth-walled, invested in mucus. Conidiogenous cells phialides, subcylindrical to obclavate with distinct flaring collarettes, hyaline, smooth-walled, 11-19 (-25) X 2.5-3.5 ($\bar{x}$= 15.5 X 3) µm. Conidia blastic-phialidic, fusiform with an acute apex and a narrow truncate base,

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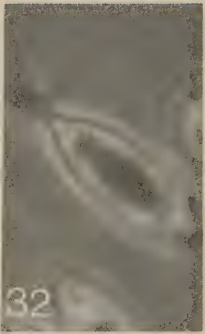
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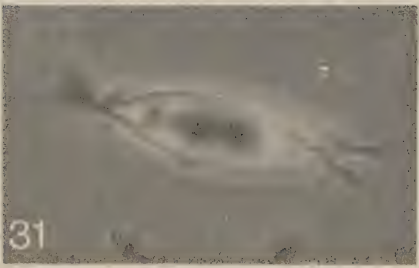
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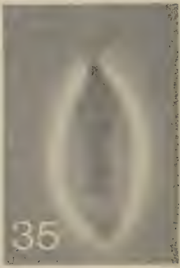
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Figures 29-35. **Koorchaloma okamurae** ex isotype in DAOM 187213. Fig. 29. Vertical section of a conidioma. X 205. Fig. 30. Excipular elements, conidiogenous cells and conidia. X 1200. Figs. 31 & 32. Mature conidia from aqueous mounts. X 2000. Fig. 33. Phialides. X 2000. Figs. 34 & 35. Mature conidia from lactic acid mounts. X 2000. (All phase contrast).

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unicellular, hyaline, smooth-walled, 10-14 X 3.5-5 ($\bar{x}$= 12 X 4.2) µm, bearing a funnel-shaped, mucoid, 2.5-3 µm long appendage at the apex and on a few conidia at the base as well; mean conidium length/width ratio= 2.8:1.

Habitat: On dead culms of _Sinobambusa tootsik_.

Specimen examined: Herb. Fac. Agr. Univ. Yamaguti (Type), Arasiyama, Kyôtô-si, Kyôtô Pref., Japan, 27.VIII.1960, H. Okamura & H. Muroi. (Isotype in DAOM 187213).

Known distribution: Japan.

Teleomorph: Unknown.

Unexamined taxon.

Agnihothrudu (1963) described _Koorchaloma okamurae_ Hino & Katumoto var. _assamica_ Agnih. from dead leaf sheaths of bamboo growing in the Tocklai campus in Assam, India. The variety _assamica_ was believed to differ from the variety _okamurae_ in its larger conidiomata, smaller sterile setae distributed throughout the conidioma and the presence of brush-like mucoid appendages. The type specimen is not accessible for study.

KOORCHALOMELLA Chona, Munjal & Kapoor

Indian Phytopath. 11: 130,1958 (1959).

Foliicolous. Conidiomata sporodochial, scattered to gregarious, superficial, pulvinate, with or without a white fringe of sterile hyphae enveloping a flesh coloured center; sterile hyphae absent or variable in

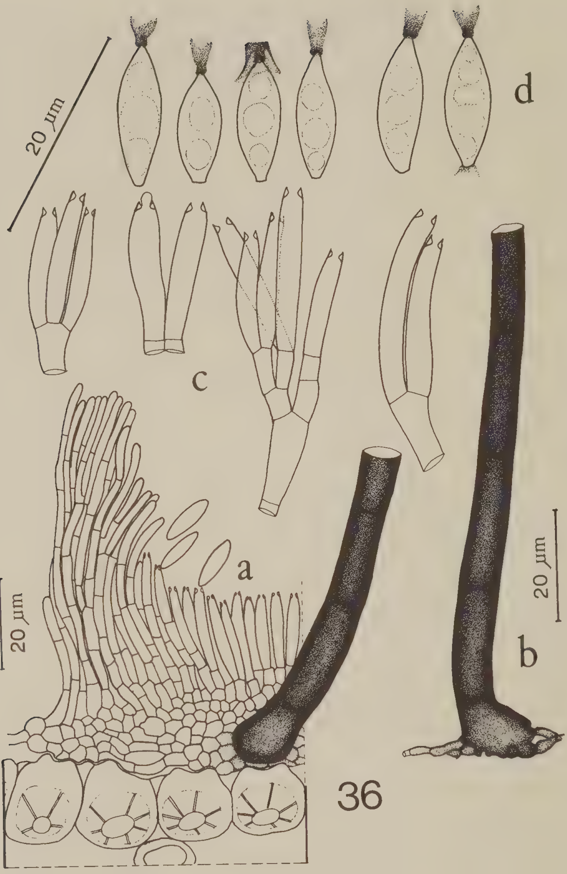

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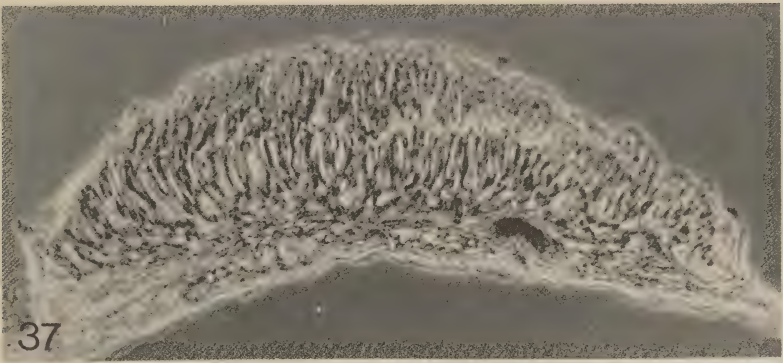
Figure 36. **Koorchaloma okamurae** ex isotype in DAOM 187213. a. Basal stroma, excipular elements and conidiogenous cells. b. Seta c. Phialides. d. Mature conidia.

Figures 37-42. **Koorchalomella oryzae** ex type in HCIO 25558. Fig. 37. Vertical section of a conidioma. X 480. Figs. 38-40. Phialides. X 2000. Figs. 41 & 42. Mature conidia. X 2000. (All phase contrast).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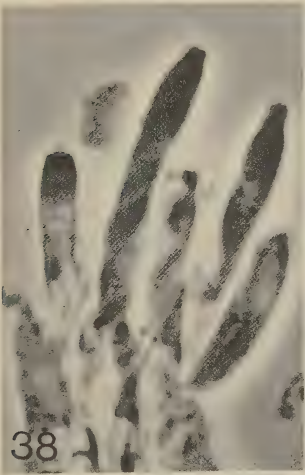
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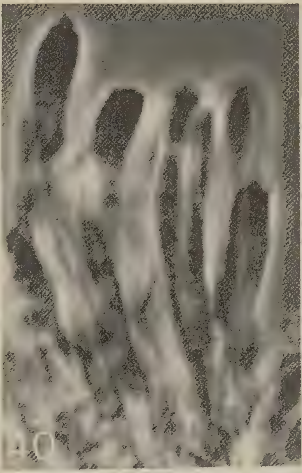
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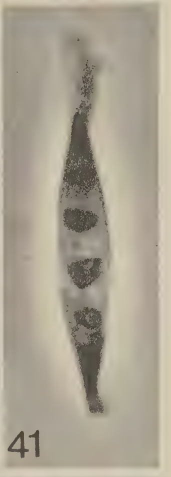
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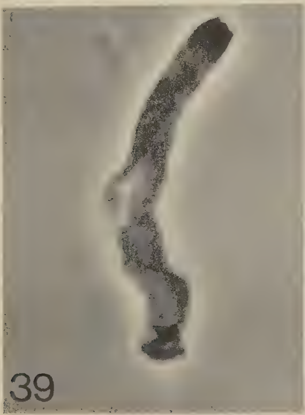
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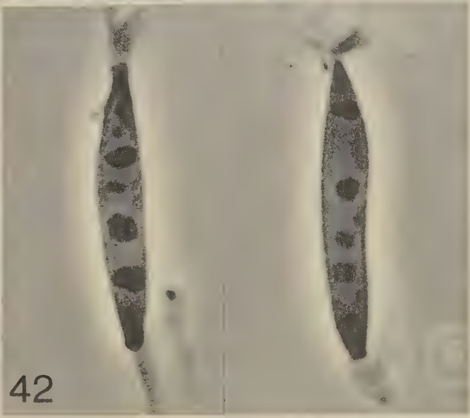
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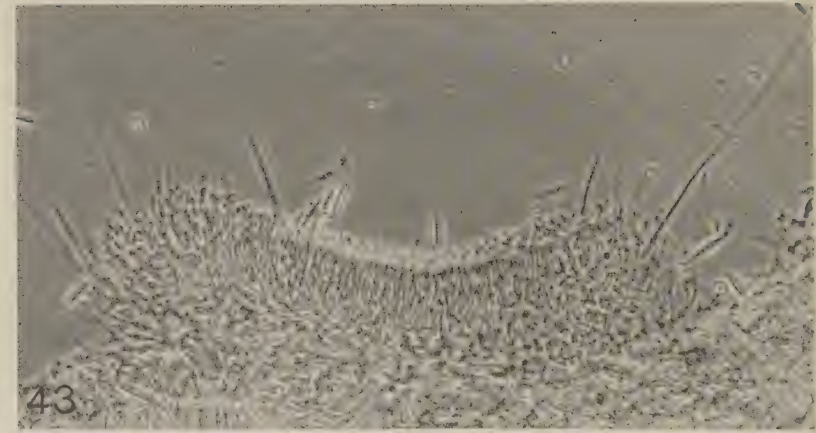

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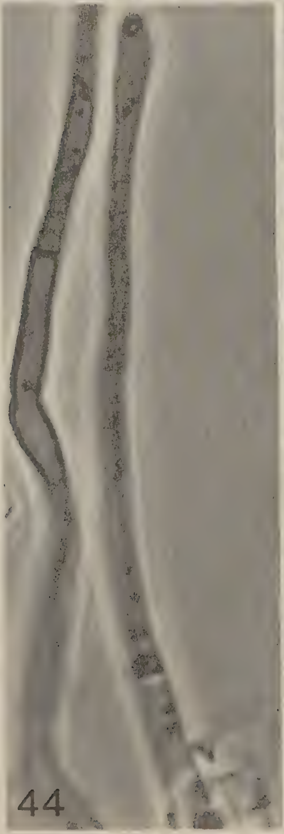

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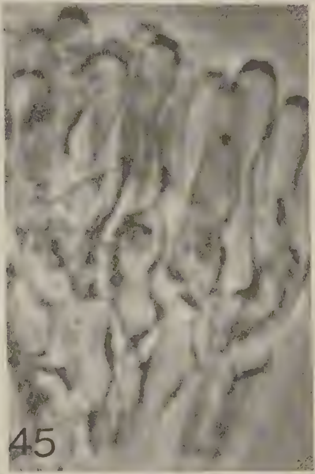

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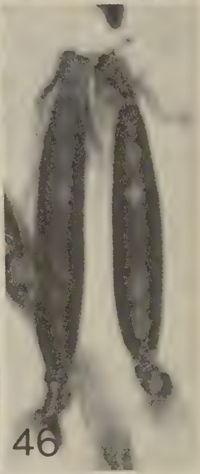

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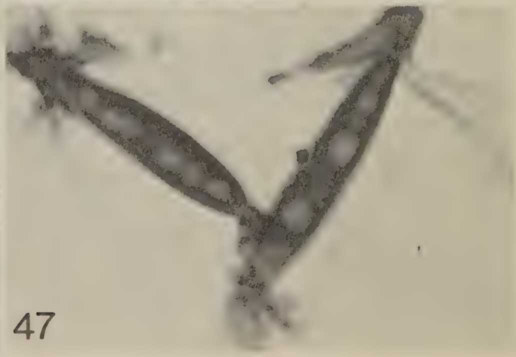

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Figures 43-47. **Koorchalomella oryzae** ex DAOM 187214. Fig. 43. Vertical section of a conidioma. X 260. Fig. 44. Sterile hyphae. X 2000. Fig. 45. Conidiophores and phialides. X 2000. Figs. 46 & 47. Mature conidia from aqueous mount. X 2000. (Figs. 43-45 Phase contrast; Figs. 46 & 47 bright field).

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development, short and intermingled with context of the sporodochium or long and extending well above the conidioma, simple, erect or bent or flexuous, septate, hyaline, thin- and smooth-walled, with spathulate tips. Conidiophores arising from a thin basal stroma, branched, septate, hyaline, smooth-walled, invested in mucus. Conidiogenous cells phialides, arranged in a dense palisade, more or less obclavate to subcylindrical, hyaline, with distinct flaring collarettes and periclinal thickenings. Conidia blastic-phialidic, fusiform to ellipsoid, unicellular, hyaline, smooth-walled, bearing a funnel-shaped mucoid appendage at each end.

Type anamorph-species: **Koorchalomella oryzae** Chona, Munjal & Kapoor.
Teleomorph: Unknown.

Koorchalomella oryzae Chona, Munjal & Kapoor.
Indian Phytopath. 11: 130, 1958.
Figs.37-56.

Foliicolous. Conidiomata sporodochia, scattered to gregarious, superficial, pulvinate, circular to oval in outline, 200-1100 µm diam, 110-420 µm deep, waxy in appearance when dry, salmon or flesh coloured when fresh, gelatinous, most often with a thin or well developed white fringe of sterile hyphae; sterile hyphae, when present, variable in size from short and often indistinct from other elements of the sporodochium to well-developed, simple, erect, bent or

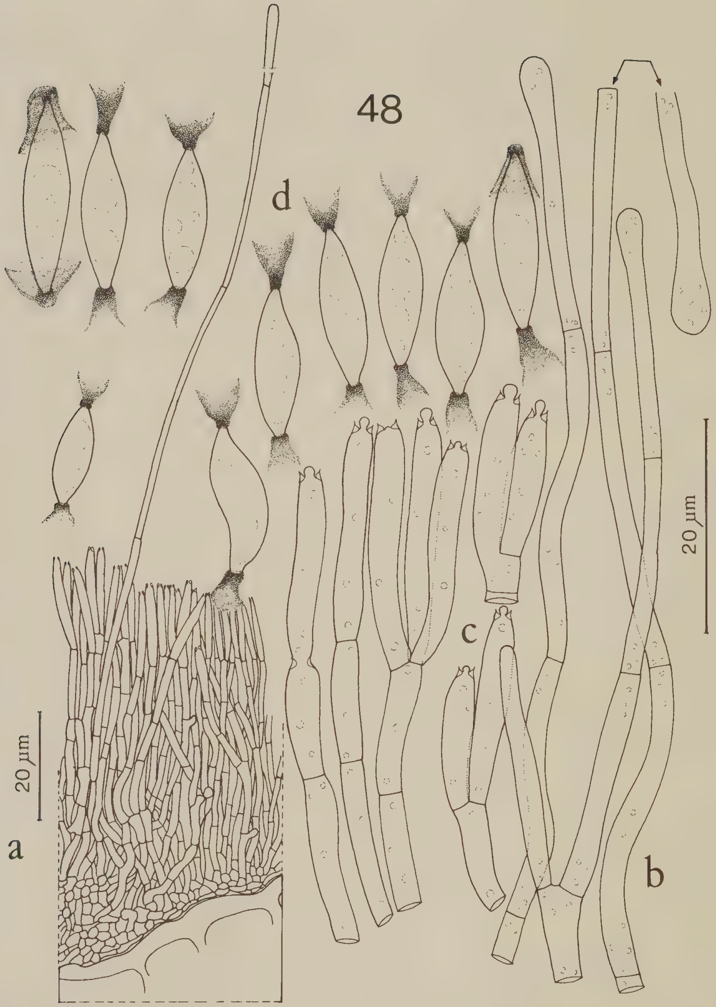
48
a
b
c
d
20 µm
20 µm

Figure 48. **Koorchalomella oryzae** ex DAOM 187214. a. Tissue details of a conidioma. b. Sterile hyphae. c. Conidiophores and phialides. d. Mature conidia.

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flexuous, septate, hyaline, thin- and smooth-walled, up to 200 µm long, 2-3 µm wide at the base and up to 5 µm wide at the spathulate apex. Conidiophores arising from a thin, hyaline, basal stroma of 'textura angularis', branched, septate, hyaline, with smooth walls, terminating in one to three, conidiogenous cells, invested in mucus. Conidiogenous cells phialides, obclavate to subcylindrical, hyaline, smooth-walled, 15-25 (-31) X 2.5-3.5 (-4) ($\bar{x}$= 21 X 3) µm. Conidia blastic-phialidic, fusiform to elliptic, occasionally naviculate, straight or slightly curved, unicellular, hyaline, smooth-walled, guttulate, 10-23 X 3-4.5 ($\bar{x}$= 17 X 3.7) µm, bearing a mucoid appendage at each end (often at the apex only); appendage funnel-shaped, 3-7 µm long, 2-3 µm wide; mean conidium length/width ratio= 4.6:1.

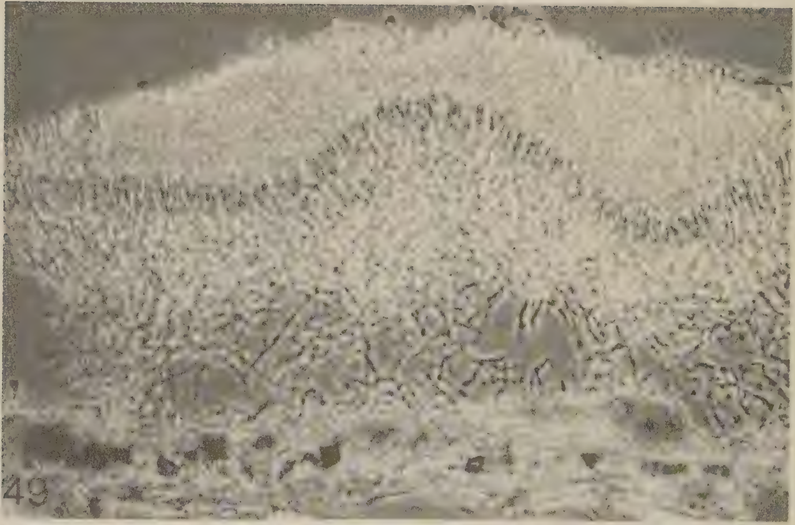
Habitat: On dead culms and leaves of _Oryza sativa_.

Specimens examined: 1. HCIO 25558 (Type), Mycological area, Indian Agricultural Research Inst., New Delhi, 10.VIII.1956, R.L.Munjal & J.N.Kapoor; 2. DAOM 187214, Rajajinagar, Bangalore, India, 23. VIII. 1970, T. R. Nag Raj (in association with _Koorchaloma madreeya_ and its teleomorph); 3. IMI 82629, isolated from soil, University of Lucknow, Lucknow, India (no other data); 4. BPI, on decaying culms of _Zizania_ sp., Louisiana, III. 1887, Langlois (sub _Pestalozziella carnea_ E. & E.).

Known distribution: India, U.S.A.

Teleomorph: Unknown.

The fungus grows well on synthetic agar culture media. In Petri dish cultures on potato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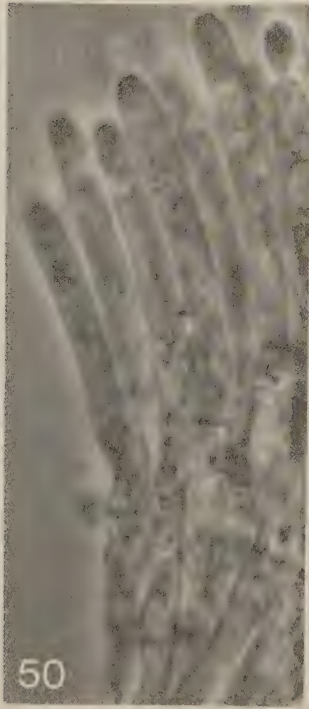
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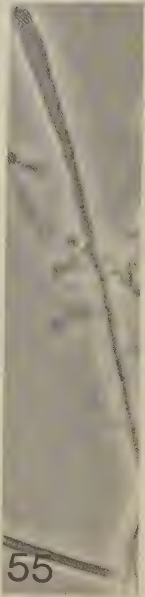
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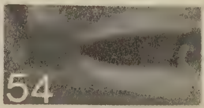
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Figures 49-55. **Koorchalomella oryzae** ex BPI and IMI. 82629. Fig. 49. Vertical section of a conidioma. X 250. Fig. 50. Conidiophores and phialides. X 2000. Fig. 51. Mature conidium. X 2000. Fig. 52. Spathulate tips of short, sterile hyphae. X 2000. Figs. 53 & 54. Stages in the eversion of conidium appendages. X 2000. Fig. 55. Sterile hypha from a culture (ex IMI 82629). X 800. (All phase contrast).

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dextrose agar at room temperatures, growth is apparent in three days as a white cottony aerial mycelium with cream coloured reverse. In about nine days colonies change to buff brown or gray brown, with cottony patches in the center and flat spreading margins. In reverse, colonies are cream coloured with irregular brown patches. Sporulation occurs in 5-6 days. According to Rai & Tewari (1961), colonies of their isolate of the fungus on oat meal agar (age and cultural conditions not specified) were circular and zonate without any aerial mycelium and with an orange coloured reverse. On Czapek dox agar containing 0.5% yeast, the colonies were light cream coloured, a velvety turf with scattered sporodochia, the turf consisting of some beaded hyphae.

KANANASCUS gen. nov.

Ascomycetes; Unitunicatae; Sphaeriales; Sphaeriaceae pertinens.

Foliicola. Perithecia discreta, superficialia, globosa, subglobosa vel pyriformia, ubi arida collabentia, unilocularia, setosa, atrobrunnea, praeter area circa collum et ostiolum pallidior; collum papillatum; ostiolum paene circulare vel ovale; canalis apicalis periphysatis; paries externe e textura angulari, interne e textura prismatica compositus; setae perithecii circa parietem ad partem medianam enascentes, simplices, cylindraceae,

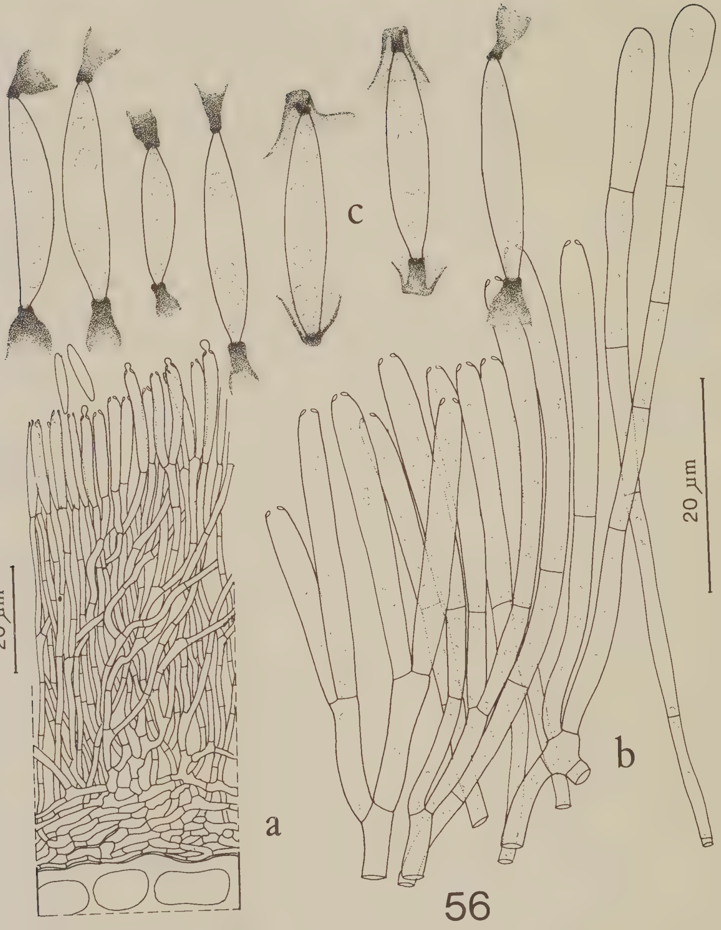

Figure 56. **Koorchalomella oryzae** ex BPI. a. Tissue details of a conidioma. b. Conidiophores, phialides and sterile hyphae. c. Mature conidia.

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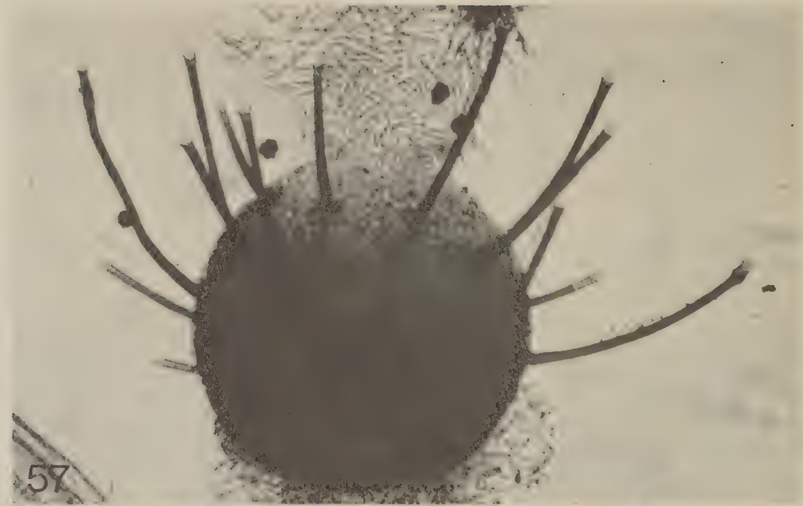
pluriseptatae, infra atrobrunneae et crassitunicatae, super pallescentes et tenuiascentes, cellula terminalis plerumque dilatata. Asci clavati, octospori, hyalini, fabrica apicalis non-amyloidea. Paraphyses nullae. Ascosporae fusiformes vel leniter sigmoideae, interdum lunatae, 1-septatae, hyalinae, laeviae vel verruculosae, guttulatae.

Typus generis: **Kananascus verrucisporus** Nag Raj.

Foliicolous. Perithecia discrete, superficial, globose, subglobose or pyriform, collapsing when dry, unilocular, setose, dark brown but becoming much lighter in the area surrounding the papillate neck and ostiole; ostiole circular or oval; apical canal periphysate; wall of an outer 'textura angularis' with thick-walled, brown to dark brown cells and an inner, lighter or subhyaline to hyaline 'textura prismatica'; perithecial setae arising all around the perithecial wall in the median part, simple, cylindrical, many septate, dark brown and thick-walled in the lower part becoming lighter and thin-walled above, terminal cell swollen and often bulbous. Asci clavate, octosporous, hyaline, apical apparatus non-amyloid. Paraphyses none. Ascospores fusiform or slightly sigmoid, occasionally lunate, 1-septate, hyaline, smooth or verruculose, guttulate.

1. **Kananascus koorchalomagnatus** sp. nov. Figs. 57-61.

Foliicola. Perithecia discreta, superficialia, globosa, subglobosa vel pyriformia, 160-300 µm diam, 180-300 µm alt., ubi arida collabentia, unilocularia, setosa, atrobrunnea, praeter area circa collum et ostiolum pallidior; collum papillatum; ostiolum paene circulare vel ovale; canalis apicalis periphysatis; paries 20-25 µm cr., externe



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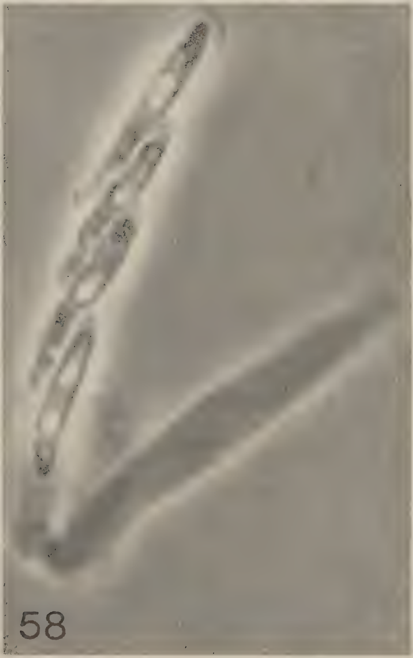

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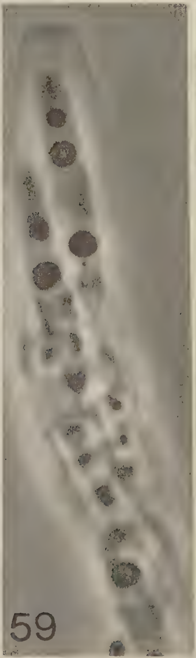

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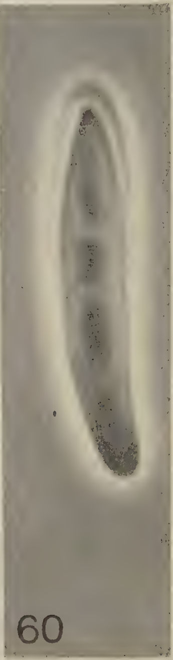

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Figures 57-60. **Kananascus koorchalomagnatus** ex type in DAOM 187215. Fig. 57. Setose perithecium. ca X 192. Fig. 58. Asci. ca X 800. Fig. 59. Ascus apex. ca X 1280. Fig. 60. Mature ascospore. X 2000. (Fig. 57 bright field; rest phase contrast).

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textura angulari in aliquot stratos e cellulis brunneis, crassitunicatis, et interne textura prismatica e cellulis pallescentes et tenuitunicatis compositus; setae perithecii circa parietem ad partem medianam enascentia, divergentes vel incurvae, simplices, cylindraceae, pluriseptatae, pro parte maxima atrobrunneae, laeviae cum tunica crasso, 90-350 µm long., 9-12 µm lat. ad basim, admodum infra cellula terminalem 7-8 µm lat.; cellula terminalis dilatata, globosa vel subglobosa, tunica tenui, subhyalina vel hyalina, ut videtur mucosa, 11-15 X 10-13 µm, interdum percurrenter crescens. Asci clavati, apice obtusi vel truncati, hyalini, cum tunica tenui et laevi, octospori, (40-) 52-71 X 7-10 ($\bar{x}$= 61.5 X 8.8) µm; fabrica apicalis non-amyloidea. Paraphyses nullae. Ascosporae fusiformes vel leniter sigmoideae, utrinque obtusae, 1-septatae, hyalinae, laeviae, paries ad septum leniter constrictum, guttulatae, 18-25 X 3.5-4.5 ($\bar{x}$= 21 X 4) µm.

Foliicolous. Perithecia discrete, superficial, globose, subglobose or pyriform, 160-300 µm diam, 180-300 µm deep, collapsing when dry, unilocular, setose, brownish black except for the lighter neck and ostiolar region; neck papillate; ostiole almost circular or oval; apical canal periphysate; wall 20-25 µm thick, composed externally of a few layers of 'textura angularis' with brown, thick-walled cells and internally of 'textura prismatica' with lighter coloured, thin-walled cells; perithecial setae arising all around the perithecial wall in the median part,

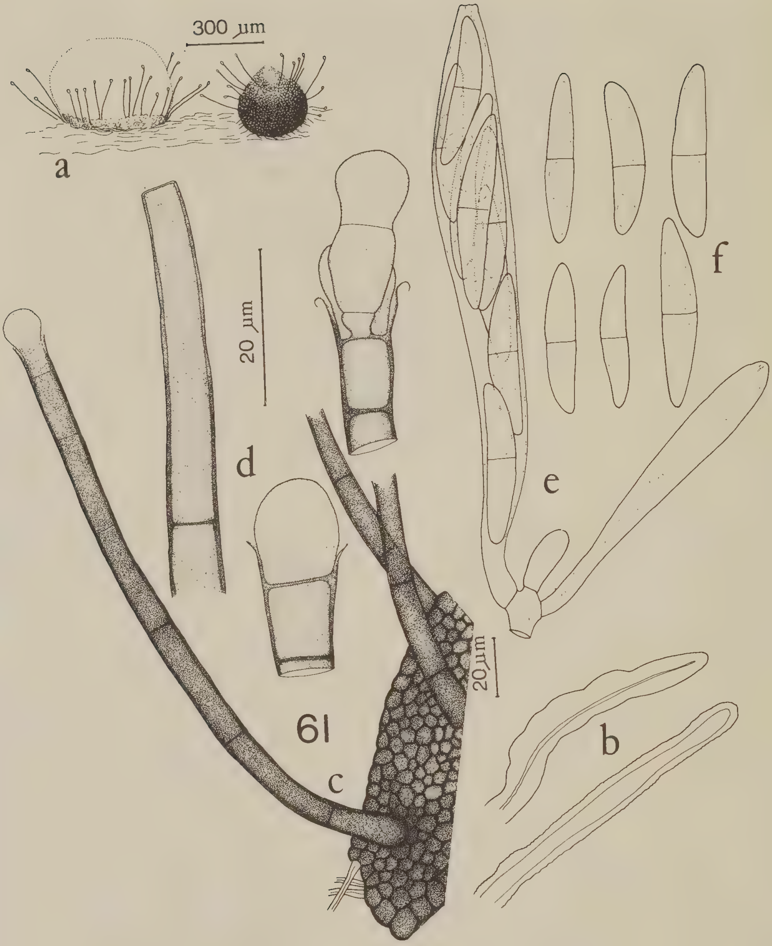


Figure 61. **Kananascus koorchalomagnatus** ex type in DAOM 187215. a. Habit sketch showing proximal association of anamorph and teleomorph. b. Details of vegetative hyphae. c. Surface view of perithecial wall. d. Apical cells of setae (one with a mere blunt apex). e. Asci. f. Ascospores.

simple, cylindrical, divergent or incurved over the ostiole, pluriseptate, dark brown, smooth- and thick-walled for most of the length, 90-350 µm long, 9-12 µm wide at the base, 7-8 µm wide below the terminal cell; terminal cell enlarged, globose to subglobose, thin-walled, subhyaline to hyaline, appearing mucoid, 11-18 X 10-13 µm, occasionally with percurrent growth. Asci clavate with a blunt or truncate apex, hyaline, thin- and smooth-walled, octosporous, (40-) 52-71 X 7-10 ($\bar{x}$= 61.5 X 8.8) µm; apical apparatus non-amyloid. Paraphyses absent. Ascospores fusiform to slightly sigmoid with blunt ends, 1-septate, hyaline, smooth-walled, wall slightly constricted at the septum, guttulate, 18-25 X 3.5-4.5 ($\bar{x}$= 21 X 4) µm, mean ascospore length/ width ratio= 5.2:1.

Habitat: On decaying leaves of *Oryza sativa*.

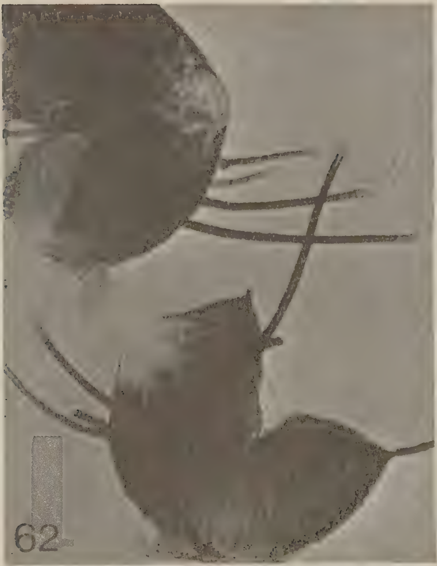
Specimen examined: DAOM 187215 (Type), Rajajinagar, Bangalore, 23.VIII.1970, T.R. Nag Raj (in association with **Koorchaloma madreeya** and **Koorchalomella oryzae**).

Known distribution: India.

Anamorph: **Koorchaloma madreeya**.

2. **Kananascus verrucisporus** sp. nov. Figs. 62-68.

Foliicola. Perithecia discreta, superficialia, globosa, subglobosa vel pyriformia, 250-300 µm diam, 290-320 µm alt., ubi arida collabentia, unilocularia, setosa, pallide brunnea ad atrobrunnea, praeter area circa collum et ostiolum pallidior; collum papillatum; ostiolum circulare vel ovale; canalis apicalis periphysatis; paries 20-30 µm cr., externe textura angulari in aliquot stratis e cellulis brunneis et crassitunicatibus, interne textura prismatica e cellulis hyalinis et tenuitunicatibus compositus; stipite basali breve, ex textura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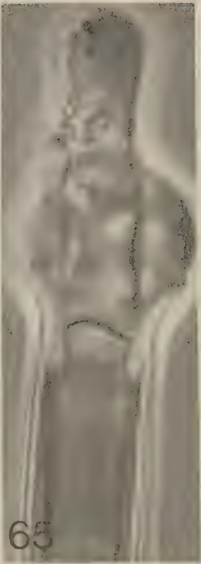
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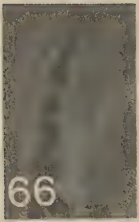
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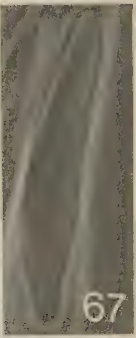
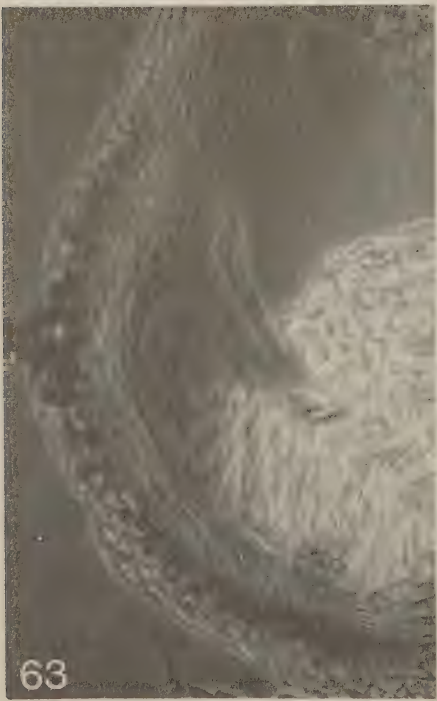
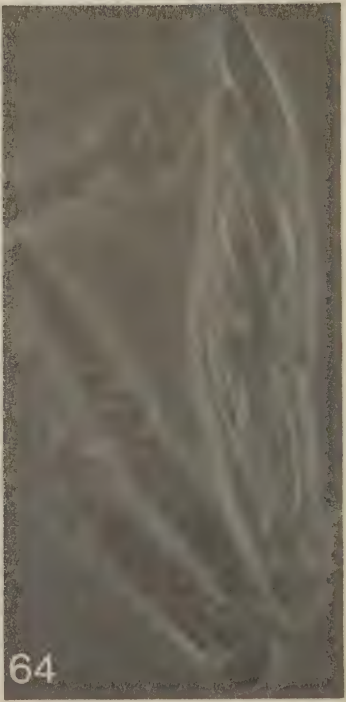

67


63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Figures 62-67. **Kananascus verrucisporus** ex type in DAOM 187216. Fig. 62. Ruptured, setose perithecia. X 150. Fig. 63. Wall details and periphyses of a perithecium. X 640. Fig. 64. Asci. X 1450. Fig. 65. Apical cell of a perithecial seta. X 2000. Fig. 66 Ascus apex. X 2000. Fig. 67. A mature, verruculose ascospore. X 2000. (All phase contrast).

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similari compositus; setae perithecii circa parietem ad partem medianum et interdum stipite basali enascentia, simplices, cylindraceae, divergentes vel incurvae, pluriseptatae, atrobrunneae, laeviae, tunica crasso, prope cellulas subterminales et terminales pallescentes et tenuiascentes, 100-300 µm long., ad basi leniter sufflatae et 10-17 µm lat., admodum infra cellulam terminalem 6-7 µm lat.; cellula terminalis subcylindracea, globosa vel subglobosa, tunica tenui, subhyalina vel hyalina, ut videtur mucosa, 8-19 X 9-12 µm, interdum percurrenter crescens. Asci clavati, apicem obtusum vel truncatum, hyalini, tunica tenui et laevi, octospori, 40-65 X 5-10 ($\bar{x}$= 52 X 8.8) µm; fabrica apicalis non-amyloidea. Paraphyses nullae. Ascosporae fusiformes ad leniter sigmoideae, interdum lunatae, utrinque obtusae, 1-septatae, hyalinae, primum laeves autem postremo verruculosae, guttulatae, 16-27 X 3-4 (-5) ($\bar{x}$= 21 X 3.5) µm.

Foliicolous. Perithecia discrete, superficial, globose to subglobose or pyriform, collapsing when dry, 250-300 µm diam, 290-320 µm deep, unilocular, setose, pale brown to brownish black except for the lighter neck and ostiolar region; neck papillate; ostiole circular or oval; apical canal periphysate; wall 20-30 µm thick, composed of an external 'textura angularis' with brown, thick-walled cells and an internal 'textura prismatica' with light coloured to

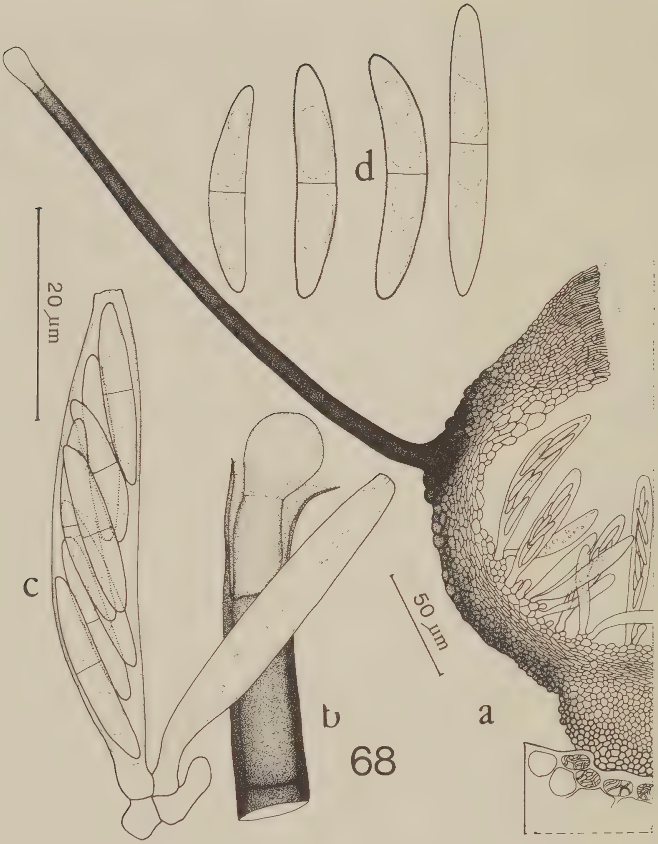

Figure. 68. **Kananascus verrucisporus** ex type in DAOM 187216. a. Sectional view of part of a setose perithecium. b. Part of a seta. c. Asci. d. Mature ascospores.

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hyaline, thin-walled cells; basal stipe short, composed of similar tissue; perithecial setae arising all around the wall in the median part of the perithecium and occasionally from the basal stipe, simple, cylindrical, divergent or incurved, many-septate, dark brown, smooth- and thick-walled, becoming lighter and thin-walled near the subterminal and terminal cells, 100-300 µm long, 10-17 µm wide at the slightly inflated base, 6-7 µm wide below the terminal cell; terminal cell subcylindrical, globose or subglobose, thin-walled, subhyaline or hyaline, 8-19 X 9-12 µm, with occasional percurrent growth. Asci clavate with a blunt or truncate apex, hyaline, thin-walled, octosporous, 40-65 X 5-10 ($\bar{x}$= 52 X 8.8) µm; apical apparatus non-amyloid. Paraphyses absent. Ascospores fusiform to slightly sigmoid, occasionally lunate, with blunt ends, 1-septate, hyaline, smooth-walled at first but ultimately verruculose, guttulate, 16-27 X 3-4 (-5) ($\bar{x}$= 21 X 3.5) µm; mean ascospore length/width ratio= 6:1.

Habitat: On grass blades.

Specimen examined: DAOM 187216 (Type), Seawind Beach Resort area, Montego Bay, Jamaica, W.I., 27.V.1978, T.R.Nag Raj.

Known distribution: Jamaica (West Indies).

Anamorph: **Koorchaloma jamaicense.**

Acknowledgments

I thank the curators of BPI, HCIO, IMI and MUBL for lending the specimens in their keeping for my study. I am indebted to Drs. Bryce Kendrick, University of Waterloo, Amy Rossman, Mycology Lab, Beltsville, Md., U.S.A., and G. L. Barron, University of Guelph, Guelph, Ontario, Canada for their objective review and criticisms of the manuscript. An operating grant from the Natural Sciences and Engineering Research Council of Canada to Dr. Bryce Kendrick financed this research.

Literature cited

Agnihothrudu, V. 1963. Notes on fungi from North-east India. XXIII. Koorchaloma okamurae Hino et Katumoto var. assamica var. nov. Sydowia 17: 168-170.

Carmichael, J.W., W.B. Kendrick, I.L. Conners & L. Sigler. 1980. Genera of Hyphomycetes. The University of Alberta Press, Edmonton, Alta., Canada. 386 pp.

Chona, B.L., R.L. Munjal, & J.N. Kapoor. 1958. Koorchalomella, a new genus of the tuberculariaceae. Ind. Phytopath. 11: 130-132.

Hino, I.1961. Icones fungorum bambusicolorum Japonicorum. The Fuji Bamboo Garden, 335 pp.

Kendrick, W.B. and J.W. Carmichael. 1973. Hyphomycetes. pp. 323-509, in The Fungi, vol.IV A, Eds.: Ainsworth, G.C., F.K. Sparrow, & A.S. Sussman, Academic Press, New York.

Rai, J.N. & J.P. Tewari. 1961. Additions to our knowledge of Indian soil fungi. Proc. Indian Acad. Sci. 54: 209-217.

Subramanian, C.V. 1953. A new genus of the tuberculariaceae. J. Ind. Bot. Soc. 32 (3): 123-126.

Sutton, B.C. 1977. Coelomycetes VI. Nomenclature of generic names proposed for coelomycetes. CMI Mycol. Pap. 141: 1-253.

MYCOTAXON

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FLORA NEOTROPICA
I. SOME LIGNICOLOUS POLYPORES FROM VENEZUELA

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This paper reports on the identity and location of lignicolous polypores collected in Venezuela by Dr. Kent Dumont and colleagues in 1972 and 1974. Historical accounts and reports of Venezuelan polypores have been given previously (Overholts, 1934; Dennis, 1970; Fidalgo and Fidalgo, 1968; and Holmquist, 1972). A recent paper listed polypores from Colombia (Setliff and Ryvarden, 1983).

The species listed herein are mostly members of the Polyporaceae, but there are examples of the Corticiaceae, Tremellaceae and Cyphellaceae. Generally the collections are fertile and in excellent condition. Poria lacteimicans Murr. and Poria umbrinescens Murr. were previously known only from the type locality. Collectors were C. Blanco, R. Cain, K. Dumont, J. Farfan, F. Malave, B. Manara, G. Morillo, and G. Samuels.

The following fungi are grouped in alphabetical order according to the specific epithet.

alabamae (Berk. & Cke.) Ryv., Pachykytospora, VE-4913, on unidentified decayed log, trail between Manacal and Los Pocitos, NW of Irapa, Edo. Sucre, 13 July 1972.

albocincta (Mass. & Cke.) Lowe, Porogramme, VE-6790, on unidentified log, ca. 7 km. S of Chichiriviche, on road between El Portachuelo and Chichiriviche, Dto. Fed.

albostygia (Berk. & Curt.) Lloyd, Poria, VE-6621, unidentified rotten log, vicinity of El Portachuelo, NE of Colonia Tovar, Dto. Fed., 29 July 1972.

caperata (Berk.) Murr., Coriolopsis, VE-6617, vicinity of El Portuchuelo, NE of Colonia Tovar, Dto. Fed.; VE-6667, ca. 6 km. NE of El Portuchuelo, on road between same and Chichiriviche, NE of Colonia; VE-6785, 7 km. S of Chichirivide; VE-6815, along Rio Aporgao, 142-143 km. S of El Dorado; VE-7091, 116-117 km. S of El Dorado, on road between El Dorado and Santa Elena de Vairén, Edo. Bolívar; VE-7199, km. 105-106 S of El Dorado, on road between El Dorado and Santa Elena de Vairén, Edo. Bolívar.

carneola Bres., Poria, VE-4963, on unidentified wood, trail from Los Pocitos through La Roma to town of Rio Grande Arriba, Edo. Sucre, 13 July 1972.

caryae (Schw.) Teix. & Rogers, Aporpium, VE-7229 and VE-7230, on unidentified wood, along Rio Sacaica, vicinity of San Rafael, km. 177-178, S of El Dorado, on road between El Dorado and Santa Elena de Vairén, Edo. Bolívar, 7 August 1972.

Drummondii Klotzsch, Coriolus, VE-3734, between refugio "No Te Apures" and Quebrada Los Palos Grandes, south facing slope of La Silla, Parq. Nac. El Avila, Edo. Mirande; VE-5228, La Carmelita, Hacienda Las Acacias, SE of Caripe, Edo. Monagas, 17 July 1972; VE-5290, vicinity of "Y Cueva del Guacharo" Caripe, Edo. Monagas, 18 July 1972; VE-5873, above Los Venadas, El Avila, Parq. Nac. El Avila, Dto. Fed., 24 July 1972; VE-6776, 7 km. S of Chichiriviche, on road between El Porachuelo and Chichiriviche, Dto. Fed., 30 July 1972.

epimiltina (Berk. & Br.) Ryv., Tinctoporellus, VE-4418, on decorticated unidentified wood, ca. 1/2 hr. walk along trail N of Manacal, NW of Irapa, Edo. Sucre, 9 July 1972.

ferreus (Fr.) Bourd. & Gal., Phellinus, VE-7229, on unidentified wood, along Rio Sacaeca, vicinity of San Rafael, km. 177-178 S of El Dorado on road between El Dorado and Santa Elena de Vairén, Edo. Bolívar, 7 August 1972.

lacteimicans Murr., Poria, VE-7217, on unidentified wood, km. 97-98 S of El Dorado, on road between El Dorado and

Santa Elena de Vairén, Edo. Bolivár, 6 August 1972.

minimus (Cke. & Phil.) Kuntze, Henningsomyces, VE-7323, on unidentified twig, trail between Manacal and Los Pocitos, NW of Irapa, Edo. Sucre, 13 July 1972.

mollusca (Pers.: Fr.) Cke., Poria, VE-4932, on unidentified wood, trail between Manacal and Los Pocitos, NW of Irapa, Edo. Sucre, 13 July 1972.

pinsitus (Fr.) Pat., Coriolus, VE-4124, along road between Mundo Nuevo and Manacal, ca. 6-10 km. N of Rte. 9, NW of Irapa, 7 July 1972; VE-4677, trail from Los Pocitos, 1-1/2 hr. walking toward Santa Isabel, NW Irapa, Edo. Sucre, 11 July 1972; VE-4874, trail from Los Pocitas through La Roma to town of Rio Grande Arriba, 13 July 1972; VE-4989, trail from Los Pocitas through La Roma to town of Rio Grande Arriba, 13 July 1972; VE-5220, La Carmelita, Hacienda Las Acacias, SE of Caripe, Edo. Monagas, 17 July 1972; VE-6789, ca. 7 km. S of Chichiriviche, on road between El Portachuelo and Chichiriviche, 30 July 1972.

poriaeforme (Pers.: Fr.) W.B. Cooke, Porotheleum, VE-6332, on unidentified wood, vicinity of El Arado, ca. 12 km. SW of Macarao, Edo. Miranda, 28 July 1972.

punctatus (Fr.) Pilát., Phellinus, VE-5683, on unidentified wood along Rio Los Caracas, S of Los Caracas, Dto. Fed., 22 July 1972.

sagraeanus (Mont.) Murr., Fomes, VE-6039 and 6046, trail between Manacal and Los Pocitos, NW of Irapa, Edo. Sucre.

scabrosa (Pers.) Cunn., Trametes, VE-4026, ca. 9 km. N of El Rincon on Carupano-El Pilar Rd., Edo. Sucre, 6 July 1972; VE-4954, trail from Los Pocitos through La Roma to town of Rio Grande Arriba, Edo. Sucre, 13 July 1972; VE-5055, trail from El Rincon, E along Rio Media to peak of Palo de Agua, Edo. Sucre; VE-5102, VE-5162, ca. 6 km. E of La Toscana, Edo. Monagas, 16 July 1972; VE-6569, ca. 19 km. NE of Colonia Tovar on road between Colonia Tovar and El Tigre, Dto. Fed., 29 July 1972; VE-6668, ca. 6 km. NE of El Portachuela, on road between El Portachuela and Chichiriviche, NE of Colonia, 30 July 1972; VE-7065, vicinity of El Dorado, Edo. Bolivár, 3 August 1972.

sanguinolentus (Alb. & Schw.: Fr.) Donk., *Rigidoporus*, VE-5774, unidentified wood, along Rio Todasana, ca. 2 km. E of Todasana, Dto. Fed., 23 July 1972.

subundatus (Murr.) Ginns, *Flaviporus*, VE-6733 in part, on unidentified log, ca. 7 km. S of Chichiriviche, Dto. Fed., 30 July 1972.

tenuis (Schw.) Ryv., *Perenniporia*, VE-7218, km. 97-98 S of El Dorado, on road between El Dorado and Santa Elena de Vairén, Edo. Bolivár, 6 August 1972.

trichiliae (Pers.) Rom., *Schizopora*, VE-3758, on decorticated unidentified wood, between refugio "No Te Apures" and Quebrada Los Palos Grandes, south facing slope of La Silla, Parq. Nac. El Avila, Edo. Miranda, 1 July 1972; VE-4482, on unidentified wood, ca. 0.5 hr. walk along trail N of Manacal, NW of Irapa, Edo. Sucre, 9 July 1972; cf. *S. trichiliae*, VE-4696, on unidentified wood, trail from Los Pocitos, 1.5 hr. walking toward Santa Isabel, NW Irapa, Edo. Sucre, 11 July 1972; VE-4893, on unidentified decayed wood, trial between Manacal and Los Pocitos, NW of Irapa, Edo. Sucre, 13 July 1972; cf. *S. trichiliae*, VE-5219, on unidentified wood, La Carmelita, Hacienda Las Acacias, SE of Caripe, Edo. Monagas, 17 July 1972; VE-6409 and 6415, on stem of unidentified palm, ca. 25 km. E of Colonia Tovar, on road between El Junquito and Colonia Tovar, Dto. Fed., 29 July 1972. This fungus is a member of the *S. paradoxa* complex. Additional cultural and morphological studies are needed to sort out the American species.

umbrinescens Murr., *Poria*, VE-6450, on unidentified palm, ca. 25 km. E of Colonia Tovar, on road between El Junquito and Colonia Tovar, Dto. Fed., 29 July 1972.

versicolor (L.: Fr.) Quél., *Coriolus*, VE-4972, trail from Los Pocitos through La Roma to town of Rio Grande Arriba, Edo. Sucre, 13 July 1972.

vincta (Berk.) Cke., *Poria*, VE-5782, on unidentified wood, along Rio Todasana, ca. 2 km. E of Todasana, Dto. Fed., 23 July 1972; VE-6719, on unidentified wood, ca. 7 km. S of Chichirviche, on road between El Portachuelo and Chichiriviche, Dto. Fed., 30 July 1972. Both of these collections are of var. *vincta*. This fungus can be placed in *Rigidoporus*; however, gloeopleurous hyphae terminating in mammillate cystidia are present, a feature not present in other members of the genus.

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LITERATURE CITED

Dennis, R.W.G. 1970. Fungus flora of Venezuela and adjacent countries. Kew Bull. Add. Ser. III:i-xxxiv, Bot. Gdns Kew, p. 531.

Fidalgo, O. and M.E.P.K. Fidalgo. 1968. Polyporaceae from Venezuela. I. Mem. N.Y. Bot. Gdn. 17:1-34.

Holmquist, O. 1972. On some Venezuelan polypores important in wood decay. State Univ. Coll. Environ. Sci. For. Syracuse Univ., Ph.D. Diss. 97p.

Overholts, L.O. 1934. Hymenomycetes, p. 304-316. In C.E. Chardon and R.A. Toro, Mycological exploration of Venezuela. Monogr. Univ. P. Rico Phys. Biol Sci., p. 353.

Setliff, E.C. and L. Ryvarden. 1983. Los Hongos de Colombia, VII. Some Aphyllophoraceous Wood-Inhabiting Fungi. Mycotaxon 15:509-525.

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AN INDEX TO FUNGAL NAMES AND EPITHETS SANCTIONED BY PERSOON AND FRIES

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The reformation of Art. 13 ICBN at the Sydney Botanical Congress in 1981 renders author's citations of "pre-starting-point" taxa in many ways easier (see comments by Demoulin et al., 1981; Korf, 1982 a, b and 1983). Not all the "ex NN." citations can, however, simply be replaced by " : Fr.".

To allow the rapid retrieval of all names and epithets (for distinction see Korf, 1983) from generic down to infraspecific rank which were sanctioned by Persoon and Fries (and not only listed as synonyms), the following index has been compiled. Infrageneric taxa indicated as tribus (tr.), subtribus (str.) or simply A., B., etc., are also included. Informally introduced names of entities between subtribus and species, which have no status in questions of priority (Art. 35.2 ICBN), are omitted.

Names of "Gasteromycetes, rusts and smuts" are sanctioned in Persoon's Synopsis methodica Fungorum (arbitrarily dated in ICBN as published on 31 Dec. 1801) and those of the "Fungi caeteri" in Fries's Systema mycologicum (vol. 1 arbitrarily dated in ICBN as published on 1 Jan. 1821, vol. 2, p.1-275 in 1822, p. 276-620 in 1823, vol. 3, p. 1-259 in 1829, p. 260-end in 1832) including the Elenchus Fungorum (El.) (1828). Generic names cited in their taxonomic context in the introduction to Vol. 1 of the Systema (Roman page numbers) are considered sanctioned at that place and are listed as such in the present index (see also Donk 1962: 102). (For bibliography the reader is referred to Stafleu & Cowan, 1976). The decision about what has to be considered a "Fungus caeterus" has been taken according to modern knowledge. Thus Uredo mycophila (anamorph of Hypomyces chrysospermus) is listed by Persoon, but was sanctioned by Fries as Sepedonium chrysospermum. On the other hand, genera like Phleogena (= Pilacre) and Ostracoderma, though often listed as Gasteromycetes, were obviously sanctioned by Fries. Thus names of Gasteromycetes etc. not sanctioned by Persoon but listed by Fries have not been sanctioned and are not listed here. The few lichenized fungi covered by Fries (the sanctioning of which is still debated) are also included. Names of myxomycetes and the algal genus Cephaleuros (which start with Linnaeus, 1753) have been excluded. Epithets variously classified by Fries in different places appear here on separate lines, even though they are synonyms.

This index is not intended to replace Fries's index of his Systema and Elenchus (1832); in that index many more names and epithets are listed (even in Roman letters), some of which have not been cited in the text of the three volumes in such a way that they can be regarded as sanctioned. In addition some names appear in that index which were published by Fries, Junghuhn, Klotzsch, Kunze and Lasch in Linnaea 3-7 and a few others, and which might be regarded as sanctioned, but these are not included in the present index. Only some additional cross references have been incorporated from Fries's index (in parenthesis). Some homonymous binomials established in the Systema and Elenchus were corrected by Fries in his indices and correction slips. References to these corrections are included in the present index.

Infraspecific taxa are listed alphabetically, and the specific epithets originally designated by Fries are indicated, except that Greek letters used to indicate infraspecific taxa had to be replaced by capital Roman letters (without full stop) for technical reasons. Epithets of uncertain infraspecific rank (i.e. the initial of the generic name is repeated after the Greek letter) (e.g. Agaricus fumosus β A. polius, vol. 1: 89) are marked with an asterisk (*); it is not yet clear whether such epithets are only protected in infraspecific rank against competing synonyms (principle 3 of Korf, 1983). Names mentioned in foot-notes or appendices are marked with a question mark (?). "Species inquirendae" and other names commented on in similar terms are not regarded as sanctioned and not listed here. The spelling of v - u and i - j (before vowels) and the use of lower-case letters of epithets have been adjusted according to modern rules, as has the use of hyphens in compound epithets. Though sometimes desirable, other linguistic corrections have generally not been carried out.

Abbreviations: Ag. - Agaricus, Bol. - Boletus, Pez. - Peziza, Pol. - Polyporus, Sph. - Sphaeria, Thel. - Thelephora.

The stimulating advice given by Prof. R. P. Korf during the preparation of this index is gratefully acknowledged.

References

Demoulin, V., Hawksworth, D. L., Korf, R. P., and Pouzar, Z. (1981): A solution of the starting point problem in the nomenclature of fungi. Taxon 30: 52-63.

Donk, M. A. (1962): The generic names proposed for Hymenomycetes - XII. Deuteromycetes. Taxon 11: 75-104.

Korf, R. P. (1982 a). Citation of authors' names and the typification of names of fungal taxa published between 1753 and 1832 under the changes in the Code of Nomenclature enacted in 1981. Mycologia 74: 250-255.

Korf, R. P. (1982 b). Mycological and lichenological implications of changes in the code of nomenclature enacted in 1981. Mycotaxon 14: 476-490.

Korf, R. P. (1983). Sanctioned epithets, sanctioned names, and cardinal principles in ": Pers." and ": Fr." citations. Mycotaxon 16: 341-352.

Stafleu, F. A. and Cowan, R. S. (1976). Taxonomic literature. A selective guide to botanial publications and collections with dates, commentaries and types. 2nd Ed. Vol. I: A-G. Utrecht, Bohn, Scheltema & Holkema.

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RESOLUTION OF VARIETAL RELATIONSHIPS WITHIN THE SPECIES *HANSENULA ANOMALA*, *HANSENULA BIMUNDALIS*, AND *PICHIA NAKAZAWAE* THROUGH COMPARISONS OF DNA RELATEDNESS

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SUMMARY

The varietal relationships within the species *Hansenula anomala*, *H. bimundalis*, and *Pichia nakazawae* were determined through comparisons of DNA relatedness. *H. anomala* var. *anomala* and *H. anomala* var. *schneggii* at 94% DNA relatedness were considered to be the same taxon, whereas the 19% relatedness between *H. bimundalis* var. *bimundalis* and *H. bimundalis* var. *americana* indicates the latter variety to be a separate species. The varieties of *P. nakazawae* exhibited 41% DNA relatedness, and it is proposed that their varietal designations be retained.

INTRODUCTION

Varietal designations within fungus taxa often are established on the basis of unique morphological features (Bisby, 1953). Among the yeasts, varieties are formed on physiological characteristics as well as on novel morphology. However, genetic and molecular studies have shown many physiological and morphological features to be determined by either one or only a few genes and therefore are not representative of the whole genome (Lindegren and Lindegren, 1949; Winge and Roberts, 1949; Wickerham and Burton, 1954; Kurtzman and Smiley, 1976; Meyer et al., 1975; Starmer et al., 1978). For example, in comparisons of DNA relatedness between species of *Saccharomyces*, Price et al. (1978) showed only 11% base sequence complementarity between *Saccharomyces microellipsodes* Osterwalder var. *microellipsodes* and *Saccharomyces microellipsodes* Osterwalder var. *osmophilus* van der Walt, thereby demonstrating the two taxa to be distinct species. Conversely, the two physiological varieties of the invalidly described *Pichia vini* shared 93% DNA relatedness and were regarded as members of the same taxon (Kurtzman and Smiley, 1979). Price et al. (1978) suggested that strains showing 80% or greater DNA relatedness be considered conspecific. However, Kurtzman et al. (1980a, b) provided evidence that this figure probably can be much lower.

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[1] The mention of firm names or trade products does not imply that they are endorsed or recommended by the U.S. Department of Agriculture over other firms or similar products not mentioned.

Within the genera *Hansenula* and *Pichia*, varieties have been described for *H. anomala* (Hansen) H. et P. Sydow, *H. bimundalis* Wickerham et Santa Maria and *P. nakazawae* Kodama. These varieties were designated primarily on physiological characteristics. The relationship of these species with their varieties has been compared through estimates of DNA base sequence complementarity, and the taxonomic implications of these results are reported here.

MATERIALS AND METHODS

Yeast strains. Cultures of the strains studied are maintained in the Agricultural Research Service Culture Collection (NRRL), Northern Regional Research Center, and their designations and nuclear DNA base composition are given in Table 1.

DNA purification, base composition determination, and conditions for reassociation. Nuclear DNA was extracted and purified by a combination of the procedures of Marmur (1961) and Bernardi et al. (1970) as described by Price and coworkers (1978). The guanine + cytosine (G+C) content of the DNA was calculated from buoyant density in cesium chloride by using the equation of Schildkraut et al. (1962). Determinations were made

Table 1. Strains examined and their nuclear DNA base composition.

Culture Collection No.			
NRRL	CBS	Taxonomic Designation	Mol% G+C[a]
Y-366[b]	5759	*Hansenula anomala* (Hansen) H. et P. Sydow var. *anomala*	36.3 ± 0.23
Y-1773		*H. anomala* var. *anomala* (*Candida pelliculosa* Redaelli)	36.9 ± 0.10
Y-1783	605	*H. anomala* var. *anomala* (*C. pelliculosa*)	35.8 ± 0.17
Y-102		*Hansenula anomala* (Hansen) H. et P. Sydow var. *schneggii* (Weber) Wickerham	36.9 ± 0.09
Y-945		*H. anomala* var. *schneggii*	37.4 ± 0.27
Y-993[b]	113	*H. anomala* var. *schneggii*	36.7 ± 0.08
Y-5343[b]	5642	*Hansenula bimundalis* Wickerham et Santa Maria var. *bimundalis*	42.1 ± 0.10
YB-2805		*H. bimundalis* var. *bimundalis*	41.5 ± 0.09
Y-2156[b]	5644	*Hansenula bimundalis* Wickerham et Santa Maria var. *americana* Wickerham	44.0 ± 0.24
YB-2444		*H. bimundalis* var. *americana*	43.2 ± 0.12
Y-7903[b]	6700	*Pichia nakazawae* Kodama var. *nakazawae*	39.4 ± 0.08
Y-7904[b]	6701	*Pichia nakazawae* Kodama var. *akitaensis* Kodama	39.9 ± 0.17

[a] Standard deviation calculated from 3-5 determinations.

[b] Type strain.

with a Spinco Model E analytical ultracentrifuge equipped with an electronic scanner. The extent of DNA renaturation was determined spectrophotometrically by using essentially the method of Seidler and Mandel (1971) as described by Kurtzman et al. (1980a).

Single spore isolation. *Pichia nakazawae* and its variety *akitaensis* were determined to be homothallic through examination of single ascospore isolates obtained from four-spored asci. Ascospores were isolated by micromanipulation.

RESULTS AND DISCUSSION

Hansenula anomala and its variety *schneggii* were separated by Wickerham (1970) because the former is less capable of fermenting sucrose than the latter, and it does not grow in osmotic medium (10% sodium chloride plus 5% glucose in Difco yeast nitrogen base). In addition, the variety *schneggii* does not assimilate raffinose. Certain morphological differences between the varieties are evident. The variety *schneggii* produces cylindrical and often markedly elongated thread-like cells while the variety *anomala* does not. However, sexual reactions between these heterothallic taxa tend to obscure the other differences. Mating reactions between strains of the variety *schneggii* are weak, but mixtures that contain one strain of each variety show stronger reactions.

Type strains of the varieties *anomala* and *schneggii* show 94% DNA relatedness which is comparable to the complementarity shown between strains within each variety (Table 2). DNA comparisons also clearly demonstrate *Candida pelliculosa* to represent the imperfect form of *H. anomala*. In view of the high DNA relatedness between the varieties, as well as the considerable intervarietal fertility, it is proposed that the variety *schneggii* be considered a synonym of the variety *anomala*.

Hansenula bimundalis var. *bimundalis* is associated with coniferous trees in Europe and Asia, whereas strains of *H. bimundalis* var. *americana* are found with coniferous trees of the southwestern United States (Wickerham, 1965). The variety *bimundalis* assimilates D-arabinose and grows at 37°C, but the variety *americana*

Table 2. Extent of DNA relatedness between varieties of *Hansenula anomala*, *H. bimundalis* and *Pichia nakazawae*

	% DNA Relatedness with:[a]					
	H. anomala var. *anomala*	*H. anomala* var. *schneggii*	*H. bimundalis* var. *bimundalis*	*H. bimundalis* var. *bimundalis*	*H. bimundalis* var. *americana*	*P. nakazawae* var. *nakazawae*
Species/NRRL No.	Y-366[b]	Y-993[b]	Y-5343[b]	YB-2805	Y-2156[b]	Y-7903[b]
H. anomala var. *anomala* Y-1773	97					
H. anomala var. *anomala* Y-1783	93					
H. anomala var. *schneggii* Y-102		97				
H. anomala var. *schneggii* Y-945		100				
H. *anomala* var. *schneggii* Y-993[b]	94					
H. bimundalis var. *bimundalis* Y-5343[b]	3					0
H. bimundalis var. *bimundalis* YB-2805			94			
H. bimundalis var. *americana* Y-2156[b]	8		19			
H. bimundalis var. *americana* YB-2444				18	89	
P. nakazawae var. *akitaensis* Y-7904[b]			6			41

[a] Standard deviation $\leq \pm 5\%$ calculated from 2-6 determinations.

[b] Type strain.

does not. Wickerham (1965) also noted that hyphae of the variety *bimundalis* are about twice as long as hyphae of the variety *americana*. Both varieties are heterothallic. Intervarietal crosses form zygotes but ascospores are not produced. Fuson et al. (1979) noted that the G+C content of the variety *americana* was 2.5% higher than that of the variety *bimundalis*; on the basis of previous studies (Price et al, 1978), they suggested that the varieties might represent distinct species.

As seen in Table 2, the extent of DNA relatedness between the two varieties of *H. bimundalis* is only 19%, consistent with the suggestion that they are separate species. Unrelated species may be expected to show less than 10% DNA complementarity (Price et al., 1978; Kurtzman et al., 1980a, b), and the slightly greater percentage shown here is in keeping with the limited mating response. These data also indicate that this pair represents only recently evolved sibling species whose divergence may be attributed to allopatry. Earlier we had shown about 25% DNA relatedness between *Pichia amylophila* Kurtzman et al. and *P. mississippiensis* Kurtzman et al., heterothallic species that exhibited good interspecific mating, but which produced only poorly formed and infertile ascospores (Kurtzman et al., 1980a). A somewhat different relationship was reported for *Issatchenkia scutulata* (Phaff et al.) Kurtzman et al. var. *scutulata* and *I. scutulata* (Phaff et al.) Kurtzman et al. var. *exigua* (Phaff et al.) Kurtzman et al. where DNA relatedness between the varieties was about 25%, but a few fertile progeny resulted from the intervarietal crosses and varietal designations were maintained (Kurtzman et al., 1980b). Consequently, *H. bimundalis* provides one more example among the yeasts that the extent of DNA relatedness parallels mating competence and fertility, and that the resolution afforded by whole genome DNA comparisons goes no further than to sibling species.

In keeping with the data presented here, it is proposed that the variety *americana* be elevated to species level.

Hansenula americana (Wickerham) Kurtzman comb. nov. Basionym: *Hansenula bimundalis* Wickerham et Santa

Maria var. americana Wickerham. Mycopathol. Mycol. Appl. 26:97, 1965.

The remaining taxa under study, Pichia nakazawae and its variety akitaensis, were described from Japan (Kodama, 1975). The variety nakazawae was isolated from exudate of Quercus myrsinaefolia Blume, whereas the variety akitaensis came from exudate of Salix sp. In standard physiological tests, the variety akitaensis differs from the variety nakazawae by its failure to ferment galactose, by the presence of a weak and slow sucrose fermentation, and by its inability to assimilate L-rhamnose and lactic acid. Another difference is the formation of moderately well-developed pseudohyphae by the variety akitaensis. In the present study, single-ascospore isolates from four-spored asci showed both varieties to be homothallic, thus complicating verification of relatedness through mating studies.

The extent of DNA relatedness between the varieties of P. nakazawae was 41% (Table 2). As discussed earlier, limited intervarietal fertility might be found even at this low level of DNA relatedness; for this reason, it is suggested that the varietal designations be maintained rather than elevating the variety akitaensis to specific rank.

DNA base sequence complementarity provides a means for assessing relatedness between taxa not amenable to resolution by other methods. Correlation of DNA relatedness with mating reactions is essential if results from this technique are to be equated with actual biological phenomena. To date, there have been few studies investigating this aspect of molecular evolution (Fuson et al., 1979; Kurtzman et al., 1980a, b), and the present work with H. bimundalis provides additional guidance. Work with other taxa will be required before firm guidelines can be established. However, it appears that the degree of mating response parallels the extent of base sequence divergence. Exceptions to this trend, not yet detected, would include amphidiploidy and such chromosomal changes that would genetically isolate populations despite relatively high DNA relatedness.

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LITERATURE CITED

Bernardi, G., M. Faures, G. Piperno, and P. P. Slonimski. 1970. Mitochondrial DNAs from respiratory-sufficient and cytoplasmic respiratory-deficient mutants of yeast. J. Mol. Biol. 48: 23-43.

Bisby, G. R. 1953. An introduction to the taxonomy and nomenclature of fungi. Commonwealth Mycological Inst. Kew, Surrey, England.

Fuson, G. B., C. W. Price, and H. J. Phaff. 1979. Deoxyribonucleic acid sequence relatedness among some members of the yeast genus Hansenula. Int. J. Syst. Bacteriol. 29: 64-69.

Kodama, K. 1975. New species of Pichia isolated from tree exudates in Japan. J. Ferment. Technol. 53: 626-630.

Kurtzman, C. P. and M. J. Smiley. 1976. Heterothallism in Pichia kudriavzevii and Pichia terricola. Antonie van Leeuwenhoek 42: 355-363.

Kurtzman, C. P. and M. J. Smiley. 1979. Taxonomy of Pichia carsonii and its synonyms P. vini and P. vini var. melibiosi: comparison by DNA reassociation. Mycologia 71: 658-662.

Kurtzman, C. P., M. J. Smiley, C. J. Johnson, L. J. Wickerham, and G. B. Fuson. 1980a. Two new and closely related heterothallic species, Pichia amylophila and Pichia mississippiensis: characterization by hybridization and deoxyribonucleic acid reassociation. Int. J. Syst. Bacteriol. 30: 208-216.

Kurtzman, C. P., M. J. Smiley, and C. J. Johnson. 1980b. Emendation of the genus Issatchenkia Kudriavzev and comparison of species by deoxyribonucleic acid reassociation, mating reaction, and ascospore ultrastructure. Int. J. Syst. Bacteriol. 30: 503-513.

Lindegren, C. C. and G. Lindegren. 1949. Unusual gene-controlled combinations of carbohydrate fermentations in yeast hybrids. Proc. Natl. Acad. Sci. U.S.A. 35: 23-27.

Marmur, J. 1961. A procedure for the isolation of DNA from microorganisms. J. Mol. Biol. 3: 208-218.

Meyer, S. A., K. Anderson, R. E. Brown, M. Th. Smith, D. Yarrow, G. Mitchell, and D. G. Ahearn. 1975. Physiological and DNA characterization of Candida maltosa, a hydrocarbon utilizing yeast. Arch. Microbiol. 104: 225-231.

Price, C. W., G. B. Fuson, and H. J. Phaff. 1978. Genome comparison in yeast systematics: delimitation of species within the genera Schwanniomyces, Saccharomyces, Debaryomyces and Pichia. Microbiol. Rev. 42: 161-193.

Schildkraut, C. L., J. Marmur, and P. Doty. 1962. Determination of the base composition of deoxyribonucleic acid from its buoyant density in CsCl. J. Mol. Biol. 4: 430-433.

Seidler, R. J. and M. Mandel. 1971. Quantitative aspects of DNA renaturation: DNA base composition, state of chromosome replication, and polynucleotide homologies. J. Bacteriol. 106: 608-614.

Starmer, W. T., H. J. Phaff, M. Miranda, and M. W. Miller. 1978. Pichia amethionina, a new heterothallic yeast associated with the decaying stems of cereoid cacti. Int. J. Syst. Bacteriol. 28: 433-441.

Wickerham, L. J. 1965. New heterothallic species of Hansenula. II. Hansenula bimundalis and variety americana. Mycopathol. Mycol. Appl. 26: 87-103.

Wickerham, L. J. 1970. Hansenula H. et P. Sydow, p. 226-315. In J. Lodder (ed.), The yeasts, a taxonomic study. North-Holland Publishing Co., Amsterdam.

Wickerham, L. J. and K. A. Burton. 1954. A clarification of the relationship of Candida guilliermondii to other yeasts by a study of their mating types. J. Bacteriol. 68: 594-597.

Wickerham, L. J., C. P. Kurtzman, and A. I. Herman. 1969. Sexuality in Candida lipolytica, p. 81-92. In D. G. Ahearn (ed.), Recent trends in yeast research, Vol. 1. Spectrum Monograph Series, Georgia State University, Atlanta.

Winge, Ö. and C. Roberts. 1949. Inheritance of enzymatic characters in yeast, and the phenomenon of long-term adaptation. Comp. Rend. Trav. Lab. Carlsberg 24: 263-315.

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THE GENUS *BRASILIOMYCES* (ERYSIPHACEAE)

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摘 要

作者对下列各种的模式以及其中一些种的非模式标本进行了研究：*Brasiliomyces malvastri* VIÉGAS, *Brasiliomyces entadae* MARASAS & RABIE, *Erysiphe malachrae* SEAVER （即 *Brasiliomyces malachrae* (SEAVER) BOESEWINKEL），以及 *Erysiphe trina* HARKNESS （异名 *Californiomyces trina* (HARKNESS) BRAUN） 除 *Brasiliomyces malvastri* 的模式上已找不到任何菌体外，所有其他模式或非模式标本均在极好状态之下。全部研究过的标本均以子囊壳壁薄、色浅、半透明及由单层的细胞构成而与各自的原始描述一致。但除 *Erysiphe trina* 外的其他种均以在大多数子囊壳上有一至数根虽发育不良但明显的附属丝而与各自的原始描述不一致。从附属丝来说，*Brasiliomyces* 和 *Erysiphe* 并无根本区别，然而，由于白粉菌科包括 *Erysiphe* 在内的所有已知属均有各由几层细胞组成的内、外壁，*Brasiliomyces* 仍然是一个很有特征性的属，应承认它是一个独立的、独特的属。*Erysiphe trina* （异名 *Californiomyces trina*）必须转入 *Brasiliomyces* 并成为新组合 *Brasiliomyces trina* (HARKNESS) ZHENG comb. nov.，而 *Californiomyces* BRAUN 则降为 *Brasiliomyces* VIEGAS 的异名。在成立 *Californiomyces* 一属时，BRAUN（1981）强调了子囊具2个孢子以及孢子大小作为属的重要特征。至于作者的意见，子囊孢子的数目、大小仅仅是区分种和变种的标准而不应作为分属标准。关于 *Brasiliomyces malvastri*

和 *Brasiliomyces malachrae* 是否相同的种，尽管前者的模式标本上已经没有菌体了，根据对后者的模式标本的研究并与原来作者的描述相比较，仍可得出两者为相同的种的结论。由于 *Brasiliomyces malachrae* 是一个较早的名称，应以它取代 *Brasiliomyces malvastri* 成为该种的正确名称。

附属丝对白粉菌分类有很重要的意义，因此，在本文中作者对 *Brasiliomyces* 属的描述作了修改，承认的种共3个如下：*Brasiliomyces entadae* MARASAS & RABIE, *Brasiliomyces malachrae* (SEAVER) BOESEWINKEL 和 *Brasiliomyces trina* (SEAVER) ZHENG comb. nov. 有分种检索表，并重新描述和绘画了上述3种。

Brasiliomyces VIÉGAS was established in 1944, with *Brasiliomyces malvastri* VIÉGAS as its type species. The diagnosis of this genus was given by VIÉGAS as follows: "Peritheciis minutissimis, ab initio albidis, postremo leviter coloratis, globosis, astomis, *non appendiculatis*. Ascis clavulatis, tetrasporicis. Sporis ovoideis, hyalinis, laevibus, continuis." It is clear that 'non appendiculatis' was what VIÉGAS had taken as a generic characteristic of prime importance when he described *Brasiliomyces*.

The second species of the genus, *Brasiliomyces entadae* MARASAS & RABIE was described in 1966. The authors of this species also emphasized the absence of appendages on the perithecium as a basis for including it in the genus *Brasiliomyces*. They noticed that *Salmonia* BLUMER & MULLER 1964 (type species: *Salmonia malachrae* (SEAVER) BLUMER & MÜLLER, basionym *Erysiphe malachrae* SEAVER) and *Brasiliomyces* were hardly distinguishable. Nevertheless, they retained *Brasiliomyces malvastri* and *Salmonia malachrae* as two independent species.

In 1980, BOESEWINKEL transferred *Erysiphe malachrae* to *Brasiliomyces* and published it as a new combination, *Brasiliomyces malachrae* (SEAVER) BOESEWINKEL, thus making *Salmonia* synonymous with *Brasiliomyces*.

BRAUN (1981) also listed *Brasiliomyces malvastri* and *Brasiliomyces malachrae* as two distinct species, though he was the first one to notice that the two might be conspecific with each other.

In the same paper, BRAUN (1981) published a new genus *Californiomyces* BRAUN (type species *Californiomyces trina* (HARKNESS) BRAUN, basionym *Erysiphe trina* HARKNESS). He stated, ".......The cleistothecial wall is thin, composed of one conspicuous layer. The walls are poorly pigmented, yellowish to light-brown, semitransparent. Fully mature cleistothecia have an appearance as if they are completely immature. These features of the peridium distinguish *E.* (*Erysiphe*) *trina* from the rest of the genus clearly. It is not possible to lump *E. trina* with *Brasiliomyces*. The irregularly branched, short, poorly developed appendages are always present in *E. trina*. On the other hand, the species deviates from *Brasiliomyces* in 2-spored asci. The spores are unusually large. Otherwise ascospores of a similar size are only known in *Leveillula*, *Phyllactinia* and *Pleochaeta*, but not in *Erysiphe* or *Brasiliomyces*......." It is thus obvious that BRAUN also considered the absence of appendages as a most salient feature for the genus *Brasiliomyces*.

I have studied the type specimens of all the species mentioned above. These include: *Brasiliomyces malvastri* VIÉGAS, *Brasiliomyces entadae* MARASAS & RABIE, *Erysiphe malachrae* SEAVER and *Erysiphe trina* HARKNESS. Except for the type of *Brasiliomyces malvastri* on which no fungus can be found anymore, all other type or non-type specimens are in excellent condition. All specimens studied agree with their original descriptions in having a perithecial wall that is very thin, light coloured, semitransparent and composed of only one layer of cells. They do not agree with their original descriptions, with the exception of *Erysiphe trina*, in having one to several appendages which are evident, though rudimentary, on most of the perithecia. There is no fundamental difference between *Erysiphe* and *Brasiliomyces* as regards appendages. Nevertheless, since all known genera of Erysiphaceae including *Erysiphe* have both outer and inner walls each composed of several layers of cells, *Brasiliomyces* is still a very characteristic and should be recognized as an independent, unique genus. *Erysiphe trina* (synonym *Californiomyces trina*) must be transferred to *Brasiliomyces* and becomes *Brasiliomyces trina* (HARKNESS) comb. nov., and *Californiomyces* BRAUN be reduced to synonymy with *Brasiliomyces* VIÉGAS. BRAUN (1981) emphasized the 2-spored asci and the large size of the spores as important generic criteria when he set up *Californiomyces* as a new genus. In my opinion, number and size of the ascospores are merely criteria for distinguishing species or varieties and should not be used as criteria for delimitating genera in the Erysiphaceae.

Concerning the idendity of *Brasiliomyces malvastri* and *Brasiliomyces malachrae*, despite the absence of any fungus on the type material of the former, according to the study of the type specimen of the latter and comparison with the descriptions given by the original authors, it can be concluded that the two are conspecific.

In view of the importance of appendages attached to the taxonomy of the powdery mildews, the genus *Brasiliomyces* and its species are redescribed as follows:

Main Characteristics		*B. malvastri*	*B. malachrae*	
		VIÉGAS, 1944	SEAVER, 1926	the present author
Diam. of Perithecia		50-60 µm	reaching 60-75 µm	48-65(-70) µm
Appendages		absent	almost absent	0-3
Asci	Nos.	3-4	usually 3	2-3(-4)
	Size	36-40 X 28-30 µm	about 40 X 30 µm	46-58 X 33-48 µm
Ascospores	Nos.	4	evidently 5	(2-)4-5
	Size	22-24 X 15-17 µm	about 20 X 14 µm	19-24 X 13-16 µm
Host Family		MALVACEAE		

Brasiliomyces VIÉGAS, Bragantia 4:17. 1944. emend. ZHENG

Erysiphe DC.:FR., Flora Fr. 2:272. 1805. p.p. non typica
Salmonia BLUMER & MÜLLER, Phytopath. Z. 50:382. 1964.
Californiomyces BRAUN, Nova Hedwigia 34:688. 1981.

Mycelia superficial, forming haustoria in the epidermal cells of the hosts; conidia formed on conidiophores, in chains, hyaline, single celled; *Oidium* type. Perithecia non ostiolate, globose to depressed-globose or slightly irregularly globose, yellowish to light brown-coloured, wall very thin, composed of one layer of cells, not differentiated into inner and outer walls; appendages mycelium-like, rudimentary, but evident, simple or forked one to several times; asci many, in a bundle; ascospores one-celled, hyaline to yellowish. (Type species: *Brasiliomyces malvastri* VIÉGAS [= *Brasiliomyces malachrae* (SEAVER) BOESEWINKEL])

Key to the species of *Brasiliomyces*

1. Ascospores 5-8; cells of the perithecial wall daedaleoid; parasitic on Mimosaceae..................*B. entadae*
1. Ascospores fewer; cells of the perithecial wall irregularly polygonal and not daedaleoid; parasitic on other host families......................................2

2. Ascospores (2-)4-5, not exceeding 24 µm in length; parasitic on Malvaceae..........................*B. malachrae*
2. Ascospores 2, some reaching 40 µm in length; parasitic on Fagaceae...................................*B. trina*

1. *Brasiliomyces entadae* MARASAS & RABIE *in* MARASAS, Bothalia 9:204. 1966.

Epiphyllous, mycelium persistent, forming irregular white patches; perithecia gregarious, globose to slightly depressed-globose, yellow to light brown, (45-)50-75(-80) µm diam., perithecial wall thin, composed of one layer of cells, cells of the perithecial wall evidently daedaleoid when mature, (10.2-)15.2-21.5 µm diam.; appendages (0-)2-6, arising from the basal part of the perithecium, mostly simple, rarely forked once, often tortuous, rarely substraight,

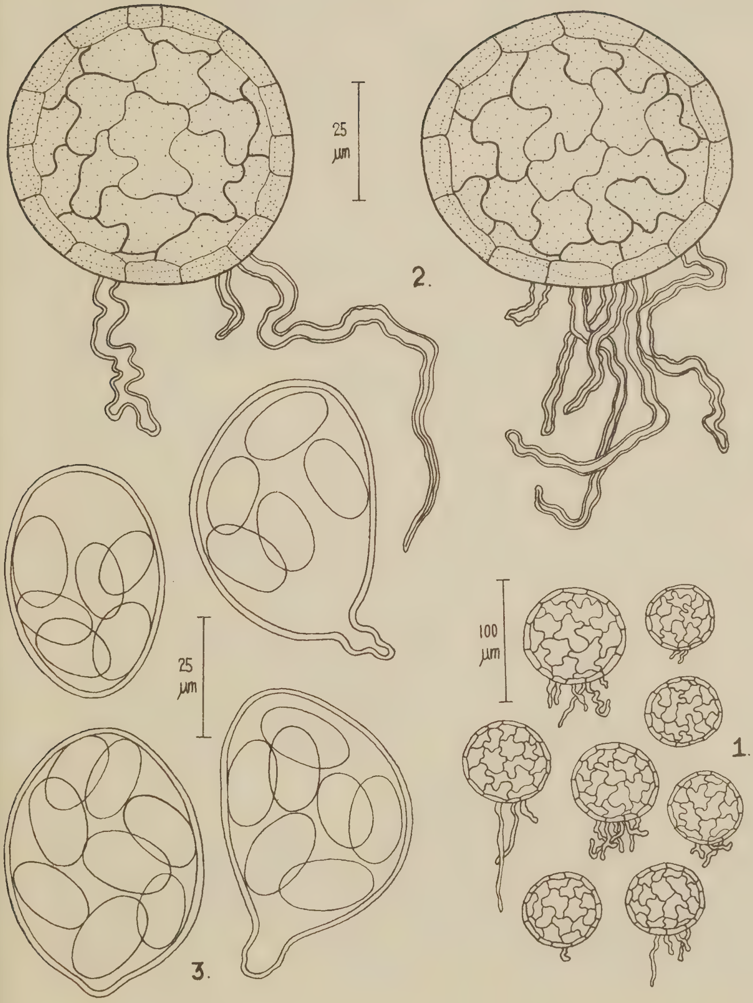
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Fig. 1. *Brasiliomyces entadae* MARASAS & RABIE: 1. & 2. Perithecia. 3. Asci and ascospores. (Host: *Entada spicata* (E. MEY.) DRUCE, isotype IMI 124287)

mycelioid, approximately (¼-)½-1(-2½) times the diameter of the perithecium and (11-)20-66(-118) µm in length, subuniform in width throughout, or slightly attenuated upwards, (2.3-)3.0-4.6 µm wide, thin walled, generally smooth, rarely subverruculose, hyaline, sometimes pale brown at the base, non-septate; asci (3-)4-5, oval or suboval, sessile, subsessile to shortly stalked, 45.7-55.9(-66.0) X 29.1-38.2 µm; ascospores 5-8, oval-elliptic, yellowish, 15.2-18.2 X 8.9-11.4 µm. (Anamorph unknown)

MATERIAL STUDIED: On *Entada spicata* (E. MEY.) DRUCE, Transvaal, South Africa, W. F. O. MARASAS & RABIE, April 1964, isotype IMI 124287.

2. *Brasiliomyces malachrae* (SEAVER) BOESEWINKEL, Bot. Rev. 46:171. 1980.

Erysiphe malachrae SEAVER *in* SEAVER & CHARDON, Sci. Surv. Porto Rico Virgin Isl. 8(1):27. 1926. (basionym)
Brasiliomyces malvastri VIÉGAS, Bragantia 4:17. 1944.
Salmonia malachrae (SEAVER) BLUMER & MÜLLER, Phytopath. Z. 50:382. 1964.

Amphigenous, mainly epiphyllous, mycelium effused, covering almost the entire surface of the leaf, subevanescent, the diseased part of the leaf slightly discoloured; perithecia subgregarious to densely scattered, subglobose to irregularly globose, 48-65(-70) µm diam., at first subhyaline, then pale brown, perithecial wall very thin, composed of one layer of cells, irregularly polygonal, inevident, about 6.3-13.2 µm diam.; appendages 0-3, simple or forked, arising from the basal part of the perithecium, curved, mycelioid, ⅕-⅔(-1) times the diameter of the perithecium, approximately 12-32(-45) µm long, subuniform in width throughout, 5.1-7.6 µm wide, 0-1-septate, thin walled, smooth, hyaline; asci 2-3(-4), oval to oval-globose, sessile, 45.7-58.4 X 33.0-48.3 µm; ascospores (2-)4-5, oblong-oval, hyaline to yellowish, granulate, 18.9-24.1 X 12.7-16.4 µm. (Anamorph not seen by the author, according to VIÉGAS (1944): Conidiophores erect, cylindric-clavate, 30-50 X 3-5 µm; conidia hyaline, smooth, in chains, chain often 150-180 µm long; *Oidium* type.)

MATERIAL STUDIED: On *Gossypium* sp., Lima, Peru, E. V. ABBOTT, May 1930, NY; on *Malachra capitata* L., Porto Rico, N. L. BRITTON & F. S. EARLE, 11 March 1922, holotype *Erysiphe malachrae* SEAVER NY 6488; on *Malvastrum coromandelianum* GRCKE, St. Paul, Brazil, A. P. VIÉGAS, 27 Feb. 1941, type *Brasiliomyces malvastri* VIÉGAS, Herbario da Seccao de Fitopatologia, Instituto Agronomico, Campinas, Brazil, no.3719.

3. *Brasiliomyces trina* (HARKNESS) ZHENG comb. nov.

Erysiphe trina HARKNESS, Bull. Calif. Acad. Sci. 1:41. 1886. (basionym)
Californiomyces trina (HARKNESS) BRAUN, Nova Hedwigia 34:705. 1981.

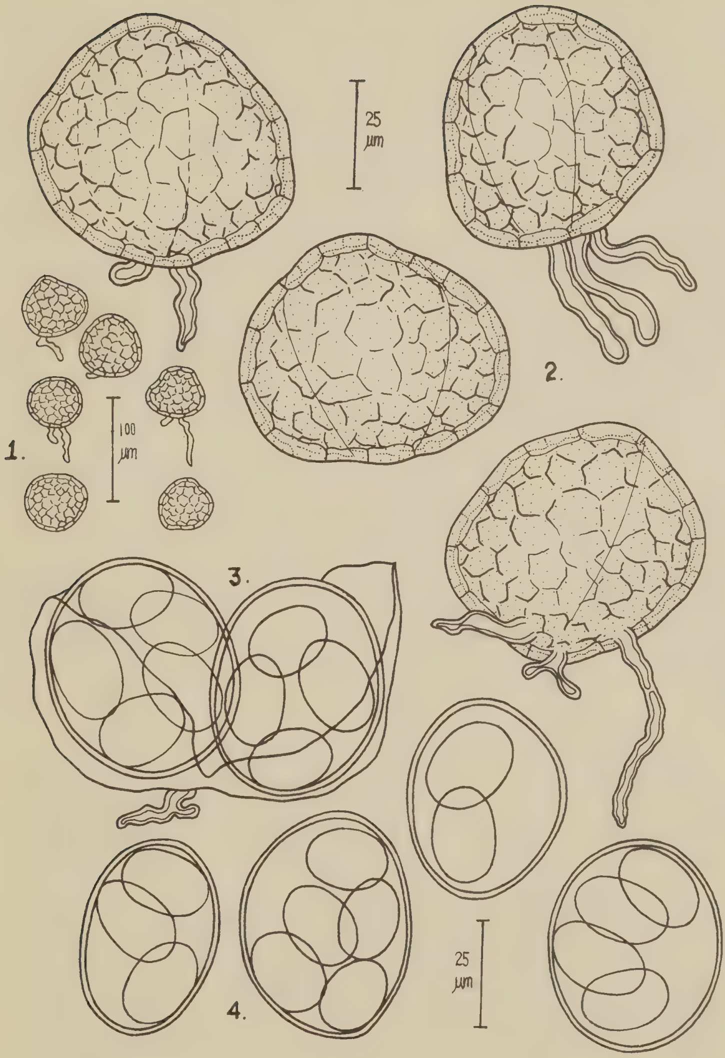
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Fig. 2. Brasiliomyces malachrae (SEAVER) BOESEWINKEL: 1. & 2. Perithecia. 3. Two asci in a broken perithecium. 4. Asci and ascospores. (Host: Malachra capitata L., holotype NY 6488)

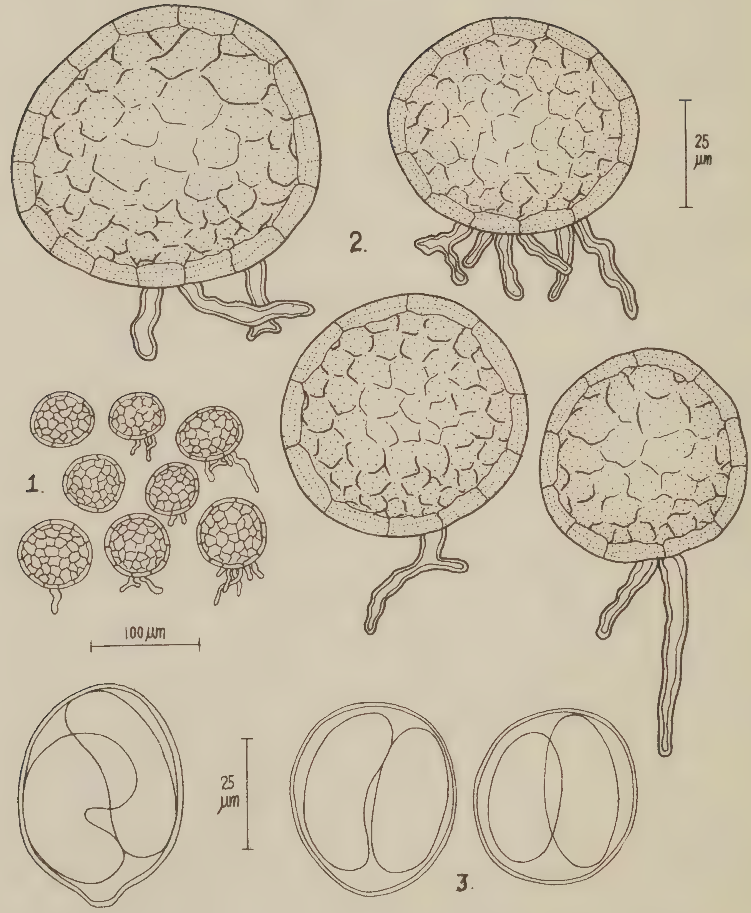
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Fig. 3. Brasiliomyces trina (HARKNESS) ZHENG comb. nov.: 1. & 2. Perithecia. 3. Asci and ascospores. (Host: Quercus agrifolia NEE, holotype CAS 2551 (BPI))

Epiphyllous, very rarely amphigenous, mycelium persistent, forming irregular or subcircular white patches; perithecia gregarious, yellow to light brown coloured, globose or depressed-globose, 50-68 µm diam., perithecial wall thin, composed of one layer of cells, cells indistinct, irregularly polygonal, 7.6-13.9 um; appendages (0-)1-4(-6), arising from the basal part of the perithecium, generally simple, rarely forked at the upper part of the appendages, curved, mycelioid, ⅕-⅓(-1) times the diameter of the perithecium, 9-20(-48) µm long, subuniform in width throughout, 3.0-5.1 µm wide, wall thin to medium in thickness, smooth, hyaline, non septate; asci 3, very rarely 2, oval, broadly oval to subglobose, subsessile to sessile, wall very thin and fragile, 40.6 -50.8 X 30.5-40.6 µm; ascospores 2, straight or curved, oblong-oval, yellow coloured, 27.9-35.6 (-40.6) X 13.9-17.8 µm. (Anamorph unknown)

MATERIAL STUDIED: On *Quercus agrifolia* NEE, California, U. S. A., H. W. HARKNESS, Jan. 1882, holotype *Erysiphe trina* HARKNESS ex CAS 2551 (BPI); California, U. S. A., M. A. HOWE, 9 March 1893, BPI; California, U. S. A., G. H. HICKS, 28 March 1894, BPI; California, U. S. A., F. T. BIOLLETI 28, 1 April 1900, BPI; San Francisco, U. S. A., M. A. HOWE, 9 March 1892, BPI.

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REFERENCES

1. BLUMER, S. & E. MÜLLER. 1964. Uber zwei Mehltauarten auf Baumwolle in Peru. Phytopath. Z. 50:379-385.

2. BOESEWINKEL, H. J. 1980. The morphology of the imperfect states of powdery mildews (Erysiphaceae). Bot. Rev. 46: 167-224.

3. BRAUN, U. 1981. Taxonomic studies in the genus *Erysiphe*. 1. Generic delimitation and position in the system of the Erysiphaceae. Nova Hedwigia 34:679-719.

4. MARASAS, W. F. O. 1966. New species of Ascomycetes and a new genus of Sphaeropsidaceae from Transvaal. Bothalia 9:203-215.

5. SEAVER, F. L. & C. E. CHARDON. 1926. Mycology. Sci. Surv. Porto Rico Virgin Isl. 8(1):1-208.

6. VIÉGAS, A. P. 1944. Alguns Fungos do Brasil II. Ascomicetos. Bragantia 4:5-392.

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HELICOMYCES TORQUATUS, A NEW HYPHOMYCETE FROM PANAMA

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ABSTRACT

Helicomyces torquatus Lane & Shearer, isolated from a twig submerged in a stream in Panama, is described and illustrated.

INTRODUCTION

A hyphomycete which produces large hyaline coiled conidia was found on a twig collected from Shannon Creek, Barro Colorado Island, Panama, following incubation in a moist chamber. This hyphomycete fits well within the generic concept of Helicomyces established by Link in 1809 in having disk-shaped conidia produced on short, erect branches from repent mycelium. The conidia of this fungus are many times larger than those of all species now included in Helicomyces and this species, therefore, is described as new.

TAXONOMIC PART

Helicomyces torquatus sp. nov. Figs. 1 - 7

Coloniae in agaro Cantinoi cum peptono fermento et glucoso mixto crescentes floccosae, primum hyalinae, in brunneum pallidum, denique atrobrunneum maturitate deficientes. Hyphae septatae, plerumque immersae, primum

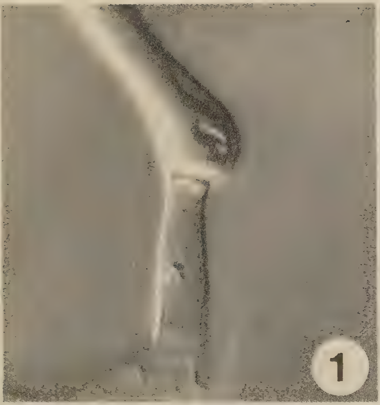
hyalinae, in subhyalinum dein pallide brunneum fuscescentes. Cellularum expansarum irregularium brunnearum vel atrarum catervae 4-5 mm cis marginem novissimum coloniae constitutae. Conidiophori micronemati, in lateribus hypharum repentium efformati, hyalini, 0-3-septati, hyalini, 0-3-septati, 19.2 - $\overline{34.1}$ - 56.4 x 3.6 - $\overline{4.5}$ - 4.8 µm. Cellulae conidiogenae hyalinae, elongatae, 12.0 - $\overline{17.8}$ - 24 x 3.6 - $\overline{4.7}$ - 4.8 µm. Conidia holoblastice, terminaliter, singillatim producta in apicibus cellularum conidiogenarum, a disjunctione ad septum inter conidium et cellulam conidiogenam secedentia, hyalina, multiseptata, per 1.8 - 2.8 revolutiones conspirata, 52.8 - $\overline{104.4}$ - 132 µm diametro, cellulis terminalibus late spatulatis, basalibus a cicatrice colligationis applanata notata, in aqua natantia hydrophobica vel explicantia ad instar torquis vel sigmoidea, 372 - $\overline{472}$ - 528 x 4.8 - $\overline{6.8}$ - 7.2 µm.

Holotypus: cultura exsiccata in caule *Medicaginis* sata, e surculo immerso in Shannon Creek, Insula Barro Colorado, Panamae, lecto sejuncta, d.20 m. Julii 1982, a C. Shearer sub numero CS-668-1, NY; cultura viva in ATCC deposita.

Helicomyces torquatus sp. nov.

Colonies on Cantino's peptone yeast glucose agar floccose, hyaline at first, turning light brown to dark blackish brown upon aging. Hyphae septate, mostly immersed, hyaline at first, becoming subhyaline to light brown. Clusters of enlarged irregular brown to black cells formed 4 to 5 mm back from leading edge of colony. Conidiophores micronematous, formed laterally on repent hyphae, hyaline, 0 to 3-septate, 19.2 - $\overline{34.1}$ - 56.4 x 3.6 - $\overline{4.5}$ - 4.8 µm.

FIGURES 1-6. *Helicomyces torquatus*. 1. Base of conidium attached to conidiogenous cell, X1,250. 2. Successive sympodial proliferations of conidiogenous cell, X875. 3. Conidium separating from conidiogenous cell X1,667. 4. Spathulate basal end cell of conidium with flattened attachment scar, X2,500. 5. Cells of conidia filled with lipid droplets, X750. 6. Conidium attached to conidiophore on natural substrata, X310.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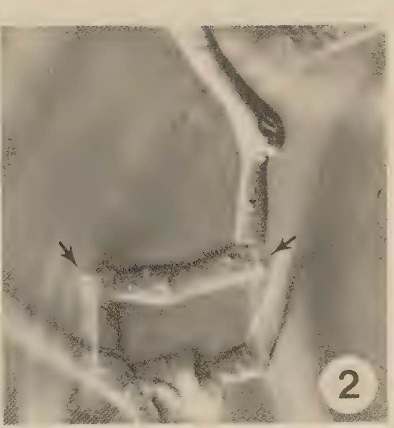
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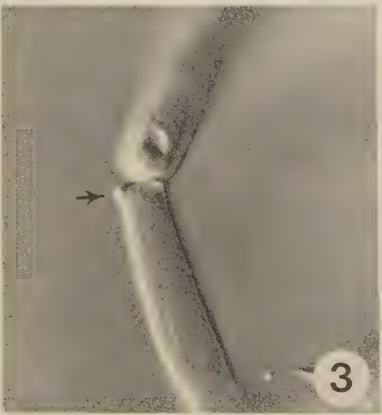
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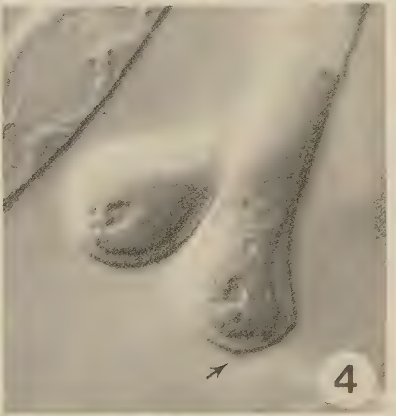
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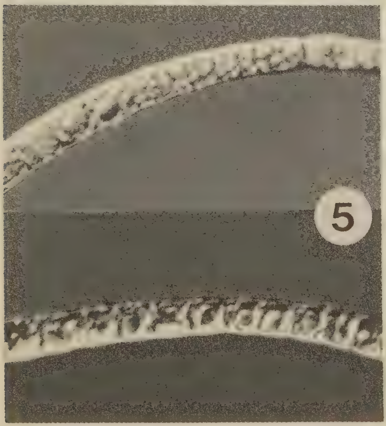
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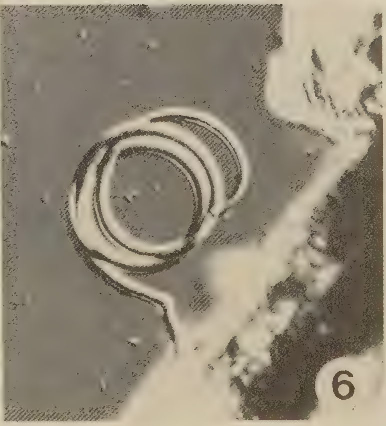

6

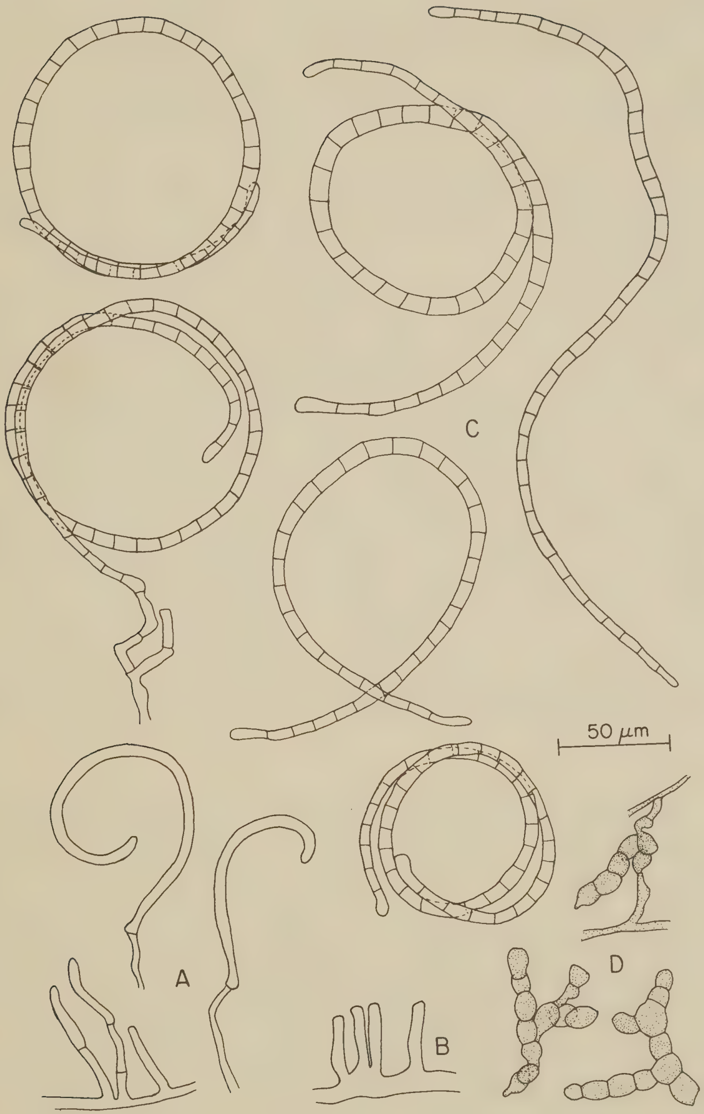
Conidiogenous cells hyaline, elongate, 12.0 - $\overline{17.8}$ - 24 x 3.6 - $\overline{4.7}$ - 4.8 µm. Conidia produced holoblastically, terminally, and singly at tips of conidiogenous cells, seceding schizolytically from conidiogenous cells. Conidia hyaline, multiseptate, coiled 1.8 to 2.8 times, 52.8 - $\overline{104.4}$ - 132 µm diam., end cells broadly spathulate, end of basal cell bearing flattened attachment scar. Conidia, in water, hydrophobic and floating or unwinding to assume a torque-like or sigmoidal form, 372 - $\overline{472}$ - 528 x 4.8 - $\overline{6.8}$ - 7.2 µm.

Holotype: A dried culture on alfalfa, isolated from an unidentified twig submerged in Shannon Creek, Barro Colorado Island, Panama, July 30, 1982, C. Shearer, CS-668-1, Type: NY; Type culture: ATCC 52531; Isotype: CMI.

Helicomyces torquatus differs from all other species of *Helicomyces* because of the large dimensions of its conidia and the spathulate end cells of the conidia (Fig. 4). Cells of the conidia are filled with large quantities of oil droplets (Fig. 5), a characteristic not reported for other species of *Helicomyces*.

Conidia develop holoblastically from the apices of conidiogenous cells; after a septum is laid down delimiting the conidium from the conidiogenous cell, uneven enlargement of the basal cell causes the conidium to appear eccentrically placed on the conidiogenous cell (Fig. 1). Liberated conidia bear a flattened scar on the basal cell indicating the site of attachment to the conidiogenous cell (Fig. 4). Eccentric placement of conidia on conidiogenous cells is found in a number of helicosporous fungi, for example, *Helicosporium pannosum* (Berk. & Curt.) R. T. Moore (anamorph of *Tubeufia helicoma* (Phill. & Plowr.) Pirozynski,) *Helicomyces fuscopes* Linder, *Helicoma anastomosans* Linder, *Helicoma tennuifolium* Linder and *Helicoma acrophalarium* R. T. Moore. Distinctions between species in *Helicoma*, *Helicosporium* and *Helicomyces* are often vague and Pirozynski (1972) has suggested that the taxonomy of micronematous

FIGURE 7. *Helicomyces torquatus*. A. Early stages of conidiogenesis. B. Spent conidiogenous cells. C. Mature conidia. D. Clusters of dematiaceous cells.


C
50 µm
A
B
D

species in those three genera might be improved by putting more weight on the characters of conidial attachment position, secondary conidia, conidiogenous cells and presence of 'sclerotes pedicelees' than on color, size and configuration of conidiophores and conidial filaments.

After conidial secession, a flat-topped conidiogenous cell remains. The lateral walls of the apex of the conidiogenous cell are thickened slightly, giving the conidiogenous cell the appearance of a phialide (Fig. 3). Successive conidia, however, were never observed developing within or through the walls of spent conidiogenous cells. Conidiogenous cells proliferated sympodially when colonies grown on Cantino's PYG agar were placed in dishes in a shallow layer of water (Fig. 2). Sympodial proliferations were not observed when the fungus sporulated on the natural substrata or on alfalfa stems. The conidiogenous cells of *H. torquatus* behave functionally much like the denticles of other helicosporous species, the major differences being of a structural nature in the large size of the conidiogenous cells and their production from repent hyphae and the wide diameter of the conidiogeneous cells relative to the diameter of conidia. Pirozynski (1972) has pointed out the structural and functional similarities between the conidiogenous cells of *Helicomyces fuscopes* and the lateral pegs of *Helicosporium pannosum*, two species with obliquely attached conidia.

Helicomyces torquatus sporulates in agar culture and when mycelial disks are halfway submerged but not covered with distilled water. Sporulation did not occur when non-sporulating or sporulating mycelial disks were completely submerged at varying depths. Abundant sporulation occurred when the fungus was grown in liquid shake culture with alfalfa stems (75 ml distilled water containing eight 5 cm pieces of alfalfa in 125 ml Erlenmeyer flasks) which were subsequently drained and transferred to moist chambers (glass Petri dish containing three pieces of moistened filter paper, sealed with Parafilm). Conidia are either hygroscopic and unwind to a torque-shaped or sigmoidal form in water (Fig. 1,C) or hydrophobic and accumulate in masses on the surface of water. Conidia frequently fragment into smaller pieces, a characteristic shared with *Helicomyces colligatus* Moore.

ACKNOWLEGEMENTS

Appreciation is expressed to Dr. C. Augspurger for collecting substrata in Panama, Dr. D. P. Rogers for preparing the Latin description and reading the manuscript and Dr. R. Goos for helpful suggestions regarding the taxonomy of this fungus and for reviewing the manuscript.

REFERENCES

LINK, H. F. 1809. Observationes in Ordines plantarum naturales. Dissertatio I ma complectens Anandrarum ordines Epiphytes. Muscedines Gastromycos et Fungos. Ges. Nat. Freunde Berlin Mag. 3: 3-42.

PIROZYNSKI, K. 1972. Microfungi of Tanzania. I. Miscellaneous fungi on oil palm. Mycol. Pap. 129: 1-29.

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SPOT TESTS FOR DETECTION OF TYROSINASE

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ABSTRACT

The relative merits of three spot test reagents [L-tyrosine, p-cresol, phenol] used for identifying tyrosinase are discussed. L-tyrosine is preferred because it is the most specific substrate of tyrosinase known, is non-autooxidizable in vitro, and is handled safely. Testing entire radial sections of sporocarps is recommended over the common practice of testing small samples in depression plates. Limitations and advantages of the tests are considered.

INTRODUCTION

When bruised, many species of mushrooms undergo melanogenesis. First a reddish compound forms [dopachrome] and later a brown to black one occurs [melanin]. Important elements of this process were first identified in *Russula nigricans* by Bourquelot and Bertrand (1895). Sporocarps of this species were boiled in ethanol and a colorless compound extracted, and identified by Bertrand (1896) to be tyrosine. When this compound was subjected to the juice of *R. nigricans*, it underwent the same color conversions as the bruised sporocarps, indicating the process to be enzymatic. Thus, the term "tyrosinase" was introduced to denote the enzyme that mediated melanogenesis.

Since Bourquelot and Bertrand's studies many more elements of this complex process have been discovered (Pawelek and Körner, 1982). Tyrosinase has been found to catalyze the oxidation of numerous phenolic compounds many of which are also catalyzed by laccase (Yasunobu, 1959; Käärik, 1965). In order to distinguish between these two modes of oxidation specific substrates of tyrosinase have been sought. Most investigations during the past four decades have repeatedly confirmed that L-tyrosine is a specific substrate of tyrosinase, and oxidation is not mediated by laccase, or is done so very slowly (Marr, 1979). Matsubara and Iwasaki (1972) regarded laccase mediated oxidation to be so slow as to be essentially negative; whereas, Fåhraeus (1961) compared the rate to that of phenol, another tyrosinase-specific substrate. After extensive comparison of substrate specificities, Yasunobu (1959) concluded that L-tyrosine is the best monophenolic substrate for mammalian tyrosinase, and indeed, this compound is used today, at very low concentrations (0.001 M), in the standard laboratory assay method for this enzyme (Decker, 1977). Besides specificity, its lack of toxicity and the absence of autooxidation in vitro recommend its use in macrochemical testing (Sax, 1981; Lerner and Fitzpatrick, 1950).

Despite these advantages, L-tyrosine has not been utilized frequently as a macrochemical test reagent because of its insolubility. At room temperature (25° C) only 0.453 g of L-tyrosine dissolves in a liter of water, and it is insoluble in absolute alcohol, ether, or acetone (Windholz, 1976). This seemingly insurmountable problem is evident in research where L-tyrosine has been employed. Boidin (1951) suspended 0.2% tyrosine in an agar medium. He started with 1.5% agar but later increased the agar content to 3%, presumably to aid suspension. The pH was adjusted to 7 for optimal enzymatic activity, but the phosphate buffer could not be added directly or tyrosine solubility was lowered further. In a colorimetric assay, Demoulin (1967) tried using tyrosine, but reactions were so slow that readings extended to 24 hours and beyond. He later switched to a 10^{-2} M solution of p-cresol in 0.05% glycine (Capellano and Demoulin, 1969). Watling (1971) noted that Sandor used a dilute solution of tyrosine in ethanol and in an ammoniacal solution, but this would also seem unsatisfactory. While tyrosine does dissolve in alkaline solutions (Windholz, 1976), increasing pH would significantly decrease tyrosinase action. Because of insolubility, other phenolic substrates have been preferred over L-tyrosine for macrochemical tests designed to detect tyrosinase.

The L-tyrosine spot test described in this paper circumvents the difficulty with solubility by dissolving L-tyrosine in boiling water and applying the reagent hot (95-100° C). The solubility of L-tyrosine increases to 5.65 g/L at 100° C (Windholz, 1976). This procedure further maximizes the reaction by destroying membranes and releasing the intracellular enzyme, and yet the reagent cools quickly on contact with the specimen, before enzymatic deactivation occurs. Within 15 min, specimens with significant levels of tyrosinase change color to brownish red (7-8 B,C 6-8 of Kornerup and Wanscher, 1967) or reddish brown (7-9 D-F 6-8), indicating a positive test for tyrosinase.

METHODS

The L-tyrosine reagent is prepared by bringing to a boil 100 ml of distilled water which contains 0.5 g of L-tyrosine. After boiling is reached, the solution is filtered directly into 30 ml amber-colored dropping bottles. Solutions prepared in this manner range in pH from 6.2 at 90° C to 7.0 at 28° C. This is in the optimal pH range for tyrosinase activity. Upon cooling, tyrosine precipitates from solution in the form of white floccose crystals. Prior to testing specimens, a dropping bottle containing the reagent [lid loosened] is put into a beaker of water and heated on a hot plate until the reagent boils and all tyrosine redissolves. While hot [95-100° C], the reagent is applied directly to specimens. The control for this test is application of hot distilled water, and for comparison, another test using 1% aqueous [v/v] p-cresol at room temperature may be performed. The p-cresol reagent, like tyrosine, is applied directly to the specimen, and the color reaction,which denotes tyrosinase occurrence, is reddish brown, slightly more brown than the reaction with tyrosine.

Specimens are prepared for testing by longitudinally sectioning entire fruiting bodies, radial sections are preferred. Testing whole radial sections allows detection of reactions in both peripheral and central regions of the sporocarp, and in all areas of the hymenophore and context. Potential reactions are less likely to be overlooked than in the common practice of testing extremely small samples in depression plates.

Sections are widely separated on a large enamel tray [30 cm x 60 cm] so that reagents do not come in contact. The entire surface of the section is flooded with the reagent. Immediately after application a timer is set for 15 min; however, it would be acceptable to extend the reaction time to 30 min. Using L-tyrosine as the standard for tyrosinase and syringaldazine for laccase, p-cresol reactions, occurring within 30 min, correlated positively with the tyrosinase standard [$P \leq 0.01$] and negatively with the laccase standard [$P \leq 0.01$] (Marr, 1979).

DISCUSSION

Besides L-tyrosine, two other candidates for detecting tyrosinase are p-cresol and phenol. As early as 1927 Pugh and Raper noted that tyrosinase catalyzes the oxidation of p-cresol, and this substrate is sometimes used in a colorimetric assay for this enzyme (Yasunobu, 1959; Nelson and Mason, 1970). In macrochemical testing, p-cresol is applied directly to sporocarps (Marr, 1979), to mycelial cultures (Holubová-Jechová, 1971), and decayed wood (Hintikka and Laine, 1970). When used in media, autoclaving causes p-cresol to autooxidize and a concentration of 0.2% is toxic to mycelial growth (Boidin, 1951). Behm and Nelson (1944a,b) studied tyrosinase catalyzed oxidation of phenol and determined that one product of this reaction is p-hydroxyquinone. In macrochemical spot tests, reaction products are initially red to violet, changing to reddish or violet brown. As with L-tyrosine and p-cresol substrates, laccase oxidation of phenol is negligible, the Michaelis constant being comparable to that of L-tyrosine (Fåhraeus, 1961). My research (1979) suggests that macrochemical spot tests, employing phenol for detecting tyrosinase, should not be extended past 15 min. Because phenol and p-cresol may be carcinogenic (Sax, 1981) and these compounds are not more tyrosinase-specific than L-tyrosine, neither reagent can be recommended over L-tyrosine.

It is often stated that p-cresol gives a more intense reaction than does L-tyrosine (Boidin, 1951); Capellano and Demoulin, 1969; Lyr, 1958; Käärik, 1965). Undoubtedly, this is a consequence of L-tyrosine's insolubility in the solvent being used. By the method outlined here, usually the two reactions are comparable in color and intensity.

However, some differences occur. Some species of the Cantharellaceae, Amanitaceae, and Russulaceae produce a stronger reaction with L-tyrosine; whereas, some species of the Boletaceae produce a stronger one with p-cresol. In one instance p-cresol turned a *Russula atropurpurea* speci- dark purple. The application of 3% hydrogen peroxide eliminated the purple pigment unmasking a brownish-red color, typical of a positive p-cresol reaction for tyrosinase.

A few sporocarps possess characteristics which interfer with the interpretation of spot tests. The most common difficulty is sporocarp color which masks any reaction that might occur in the test. For this reason, it is difficult to impossible to interpret the test results of *Fomes fomentarius*, *Phellodon niger* var. *alboniger*, *Hydnellum diabolus*, or *Craterellus fallax*. Bruising reactions can be another obstacle. Obviously, the dark blue reactions occurring in some Boletes may interfer, but tyrosinase-bruising may be a problem also. It is believed that melanogenesis deactivates tyrosinase (Clutterbuck, 1972); thus, a heavily blushed *Amanita rubescens* may yield a nearly negative tyrosinase test [even though the "blush" is a manifestation of tyrosinase activity]; whereas, its whiter counterpart will give a strongly positive test. Minor problems are leaching of sporocarp pigments into the reagent [e.g. soluble pigments of *Mycena haematopus* and *Mycena leaiana*], and resistance of waxy gills to the penetration of reagents [suspected for *Collybia dryophila*].

The majority of sporocarps present no problem in testing, and tests are easily and quickly performed. The results are specific for tyrosinase, reproducible, and can be quantified by the percent of reactive area. Spot tests are more sensitive than colorimetric methods for detecting extremely low levels of enzyme, and unlike colorimetric assays, localization of the enzyme can precisely be determined, even photographed.

ACKNOWLEDGEMENTS

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LITERATURE CITED

Behm, R. C. and J. M. Nelson. 1944a. The activity of tyrosinase toward phenol. J. Am. Chem. Soc. 66: 709-711.

_____ and _____. 1944b. The aerobic oxidation of phenol by means of tyrosinase. J. Am. Chem. Soc. 66: 711-714.

Bertrand, G. 1896. Sur une nouvelle oxydase, ou ferment soluble oxydant, d' origine végétale. C. R. Ac. Soc. 122: 1215-1217.

Boidin, J. 1951. Recherche de la tyrosinase et de la laccase chez les Basidiomycètes en culture pure. Milieux différentiels. Intérêt systématique. Rev. d. Mycol. 16: 173-197.

Bourquelot, E. and G. Bertrand. 1895. Le bleuissement et le noircissement des champignons. C. R. Soc. Biol. 47: 582-84.

Capellano, A. and V. Demoulin. 1969. Nouvelles recherches sur la distribution des phénoloxydases et des peroydases chez les Gastéromycètes. Bull. Soc. Myc. Fr. 85: 251-254.

Clutterbuck, A. J. 1972. Absence of laccase from yellow-spored mutants of *Aspergillus nidulans*. J. Gen. Microbiol. 70. 423-435.

Decker, Lillian A. (ed.). 1977. Worthington Enzyme Manual. Worthington Biochemical Corp. Freehold, N.J. pp. 66-76.

Demoulin, V. 1967. Proposition d'un processus de détection des phénoloxydases et peroxydases chez les macromycètes. Application à quelques Gastéromycètes. Planta 76: 129-137.

Fåhraeus, G. 1961. Monophenolase and polyphenolase activity of fungal laccase. Biochim. Biophys. Acta. 54: 192-194.

Hintikka, V. and L. Laine. 1970. Notes on the detection of different types of decay in wood. Comm. Instit. Forest Fenn. 70: 1-16.

Holubová-Jechová, Vera. 1971. Polyphenoloxidase enzymes from wood-inhabiting Hyphomycetes. Česká Mykol. 25: 23-32.

Käärik, Aino. 1965. The identification of the mycelia of wood-decay fungi by their oxidation reactions with phenolic compounds. Stud. Forest. Suecia 31: 1-81.

Kornerup, A. and J. H. Wanscher. 1967. Methuen Handbook of Colour. Methuen and Co. Ltd, London. pp. 243.

Lerner, A. B. and T. B. Fitzpatrick. 1950. Biochemistry of melanin formation. Physiol. Rev. 30: 91-126.

Lyr, H. 1958. Über den nachweis von oxydasen und peroxydasen bei Höheren pilzen und die bedeutung dieser enzyme für die Bavendamm-reaktion. Planta 50: 359-370.

Marr, C. D. 1979. Laccase and tyrosinase oxidation of spot test reagents. Mycotaxon 9: 244-276.

Matsubara, T. and H. Iwasaki. 1972. Occurrence of laccase and tyrosinase in fungi of Agaricales and comparative study of laccase from _Russula_ _delica_ and _R_. _pseudodelica_. Bot. Mag. (Tokyo) 85: 71-83.

Nelson, Rita M. and H. S. Mason. 1970. Tyrosinase (Mushroom). In, Methods in Enzymology. Vol. XVIIA. H. Tabor and C. W. Tabor (eds.) Academic Press, N.Y. pp. 626-632.

Pawelek, J. M. and Ann M. Körner. 1982. The biosynthesis of mammalian melanin. Am. Scientist 70: 136-145.

Pugh, C. E. and H. S. Raper. 1927. The action of tyrosinase on phenol with some observations on the classification of oxidases. Biochem. J. 21: 1370-1383.

Sax, N. I. 1981. Cancer Causing Chemicals. Van Nostrand Reinhold Co., N.Y. pp. 466.

Watling, R. 1971. Chemical Tests in Agaricology. In, Methods in Microbiology. Vol. 4. C. Both (ed.) Academic Press, N.Y. pp. 567-597.

Windholz, Martha (ed.). 1976. The Merck Index. Merck and Co., Inc., Rohway, N.J.

Yasunobu, K. T. 1959. Mode of Action of Tyrosinase. In, Pigment Cell Biology. M. Gordon (ed.) Academic Press, N.Y. pp. 583-608.

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NEW OR INTERESTING MICROFUNGI

XIII. ASCOMYCETES ON *LAURUS NOBILIS* LEAF LITTER

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INTRODUCTION

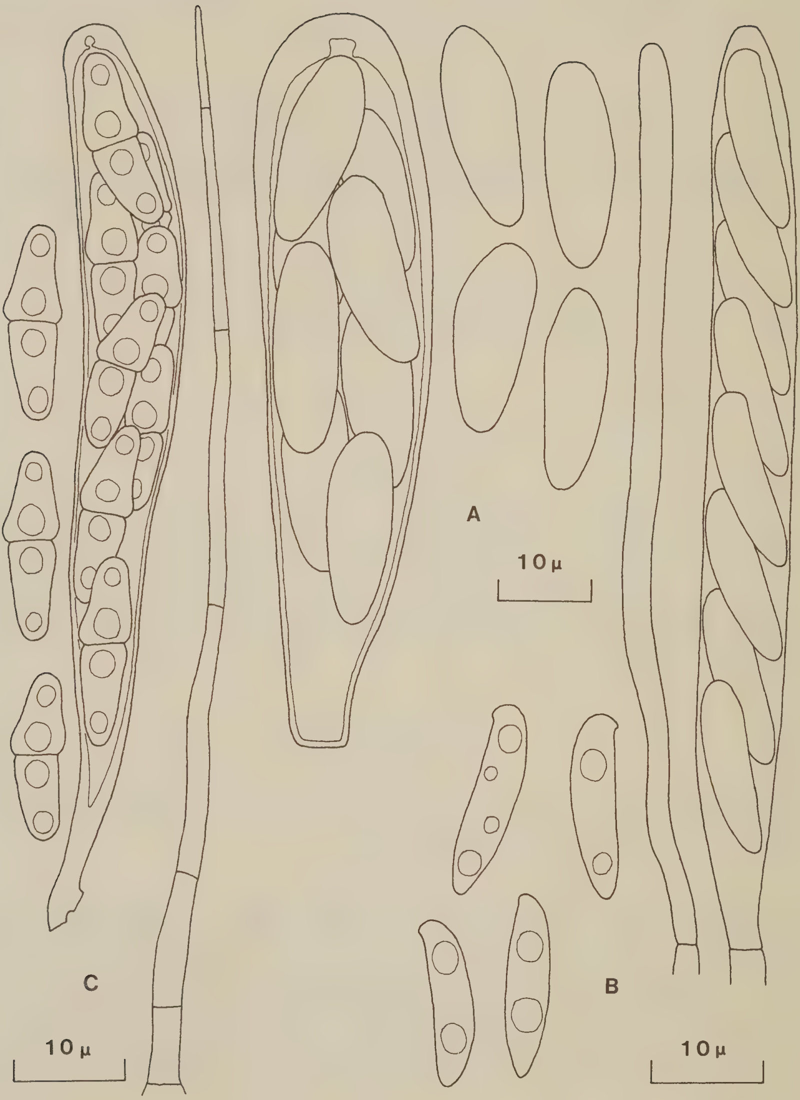
This paper is the fourth contribution in a series reporting microfungi which occur on leaf litter of *Laurus nobilis* L., the sweet bay (Kirk, 1981, 1982, 1983). In the previous contributions six species belonging in the Ascomycetes were reported. The present contribution includes data on a further twelve species with additional information for two species which were reported previously.

TAXONOMIC PART

GLOMERELLA CINGULATA (Stoneman) Spaulding & Schrenk, *Science*, Ser. 2 **17**: 751 (1903). (Fig. 1A)
For synonymy see von Arx & Müller (1954).

This species has a world wide distribution though it is more abundant in tropical and subtropical than in temperate regions. It is a serious pathogen of a wide range of cultivated and wild plants causing a variety of symptoms such as seedling blight, root rot, anthracnose of stems and leaves, dieback, leaf spot and blossom and fruit rot (Mordue, 1971). The anamorph of *Glomerella cingulata*, *Colletotrichum gloeosporioides* (Penz.) Penz. & Sacc., is especially common on material from the tropics but was not found on the present collections.

Illustrations: von Arx & Müller (1954), Mordue (1971).


A
10 μ
C
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B
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Fig. 1 (A) *Glomerella cingulata*. (B) *Hymenoscyphus phyllogenus*. (C) *Lophiostoma fuckelii*.

Specimens examined: East Lulworth, Dorset, U.K., 12 July 1981, P.M. Kirk 1044, IMI 260935; Fleet Churchyard, Dorset, U.K., 13 July 1981, P.M. Kirk 1062, IMI 260953; Lyme Regis, Dorset, U.K., 15 July 1981, P.M. Kirk 1128, IMI 261300.

HYALOSCYPHA MIRABILIS Velen., *Monographia Discomycetum Bohemiae*: 283 (1934). (Fig. 2)

Ascomata apothecioid, superficial, sessile or subsessile, white, 70-120 μm diam., with a dense marginal fringe of stiff hairs. *Hairs* subulate, smooth, slightly swollen at the base which is thin-walled, appearing solid above and without an obvious lumen, (15–) 40–90 (–120) μm long, 2·5–4·5 μm wide at the base, not reacting with KOH or Melzer's reagent. *Asci* clavate, without an obvious apical apparatus, I –ve, 8-spored, 18–24 μm long, 3–4·5 μm wide. *Paraphyses* simple, filiform, sparse, usually 1-septate, as long as or sometimes slightly longer than the asci. *Ascospores* ellipsoid, smooth, hyaline, non-septate, (3·5–) 4–5 μm long, (1–) 1·5–2 μm wide.

Specimen examined: Rayleigh, Essex, U.K., 25 Dec. 1980, B.M. Spooner, IMI 255787.

The collection cited above is in close agreement with Velenovský's fungus. His description refers to 'pilis e basi cylindrica crassa arista rigide solida stricta terminatis' – with hairs terminated by a rigidly solid drawn out tip from the broad cylindrical base, and his illustrations (Taf. XIV, 37) clearly show the structure of these hairs. According to the key provided by Korf & Kohn (1980), *Hyaloscypha mirabilis* Velen. should be referred to *Hyalopeziza* Fuckel subgenus *Unguicularia* (Höhnel) Korf & Kohn. However, since the holotype of *H. mirabilis* has not been examined here no formal transfer of the name will be made.

HYMENOSCYPHUS PHYLLOGENUS (Rehm) Kuntz, *Rev. Gen. Plant.* 3: 485 (1898). (Fig. 1B)

This species is typically a leaf inhabiting discomycete with the apothecia usually developing on the veins and midrib. It is closely related to *H. caudatus* (P. Karsten) Velen., differing from the present species by its longer ascospores and *H. albopunctum* Peck which has narrower ascospores. Dennis (1956) considered that the three species were distinguished only with difficulty and doubted the wisdom of attempting to separate them.

Specimen examined: Castell, Powys, U.K., 11 July 1981, R.W.G. Dennis, IMI 261122.

LOPHIOSTOMA FUCKELII Sacc., *Michelia* 1: 336 (1878). (Fig. 1C)

Ascomata pseudothecioid, immersed, ostiole subcircular to elongate. *Asci* clavate, (60–) 70–90 μm long, 7–9 μm wide. *Ascospores* broadly fusiform, medianly 1-septate, constricted at the septum, 4-guttulate, (12–) 14–20 (–26) μm long, 3·5–5 μm wide. *Pseudoparaphyses* simple, filiform.

Specimens examined: Wheatfen Broad, Norfolk, U.K., 25 June 1981, M.B. & J.P. Ellis, IMI 260116; Christchurch Priory, Dorset, U.K., 5 July 1981, P.M. Kirk 983, IMI 260638; Rayleigh, Essex, U.K., 5 July 1981, B.M. Spooner, IMI 261109; Studland, Dorset, U.K., 9 July 1981, P.M. Kirk 1001, IMI 260613; Tunbridge Wells, Kent, U.K., 2 Oct. 1981, B.M. Spooner, IMI 262743.

The elongate ostiole is only present on well developed pseudothecia. In adjacent, often smaller and apparently less well developed pseudothecia the ostiole is subcircular.

Saccardo (1985) described *Leptosphaeria nobilis* Sacc. from leaves of *L. nobilis* and illustrated the species in Fungi Italici Tab. 264. The asci and ascospores of this species are similar to those in the collections here referred to *Lophiostoma fuckelii* Sacc.Unfortunately, holotype material of the former species is lost (Gola, 1930) and the synonymy of these two names cannot, therefore, be established conclusively.

MELANOSPORA CHIONEA (Fr.) Corda, *Icon. Fung.* 1: 25 (1837).(Fig. 3A)

Ascomata perithecioid, superficial or immersed and becoming erumpent, subglobose to globose, 150–250 μm diam., sparsely white tomentose, the hairs hyaline and thick-walled, neck setae subulate, hyaline, thick-walled, 60–120 μm long, 3–4 μm wide. *Asci* evanescent, clavate, 8-spored, c. 48 x 12 μm. *Ascospores* ellipsoid but unilaterally flattened along one polar plane, brown to dark brown, smooth, with two polar pores c. 1·5 μm diam., 8–12 μm long, 5·5–6·5 x 4·5–6 μm wide.

Specimens examined: Rayleigh, Essex, U.K., 5 July 1981 and 20 Feb. 1983, B.M. Spooner, IMI 261114a, IMI 275858.

Apparently common in the British Isles on dead needles and sometimes cones of *Pinus sylvestris* L. although it has also been recorded on the inner surface of *Fraxinus* sp. bark (Cannon & Hawksworth, 1982).

Illustrations: Cannon & Hawksworth (1982), von Arx & Müller (1954).

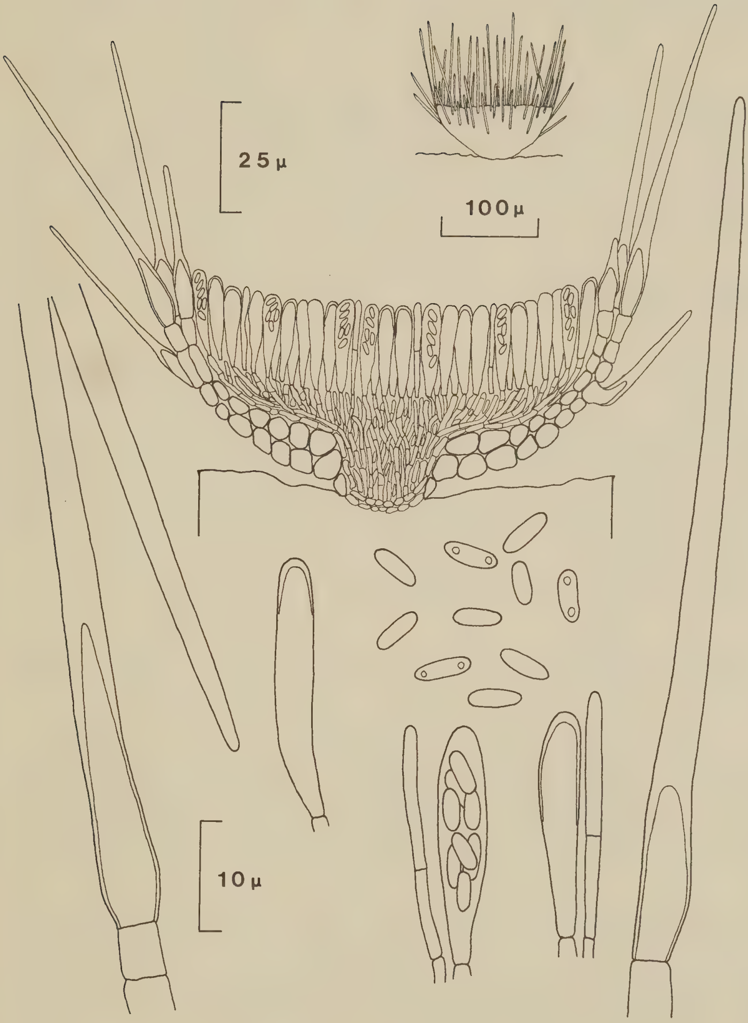
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Fig. 2. *Hyaloscypha mirabilis.*

MELANOSPORA LONGISETOSA P. Cannon & D. Hawksw., *Bot. J. Linn. Soc.* 84: 130 (1982). (Fig. 3B).

Ascomata perithecioid, immersed, becoming erumpent, 150–300 μm diam., neck setae subulate, hyaline, thick-walled, 200–300 μm long, 3–5 μm wide. *Asci* rapidly evanescent, broadly clavate, 4–spored. *Ascospores* broadly ellipsoid but unilaterally flattened along one polar plane, brown, smooth, with two polar pores c. 2 μm diam., 14–19·5 μm long, 11–14·5 x 7·5–10 μm wide.

Specimen examined: Tarrant, near Blandford, Dorset, U.K., 12 July 1982, R.W.G. Dennis, IMI 270837a.

Cannon & Hawksworth (1982) described this dinstinct species, from twigs of *Ulmus* sp., growing in close association with and reported as probably parasitic on the *Tubercularia* anamorph of *Nectria cinnabarina* (Tode) Fr. In the present collection there is no evidence of parasitism, the perithecia being randomly dispersed on the leaf, and the close association with another fugus in the holotype specimen is likely to be fortuitous.

The collection cited above would appear to be only the second published record of this species.

Illustrations: Cannon & Hawksworth (1982).

MICROTHYRIUM ILICINUM de Not., *Erb. crittog. ital.* ser. 1, no. 994 (1862). (Fig. 4A)

Ascomata thyrothecioid, orbicular, 140–250 μm diam. *Asci* cylindrical to narrowly obclavate, 50–70 μm long, 8–11 μm wide. *Ascospores* narrowly ellipsoid to broadly fusoid, 1-septate, the upper cell slightly broader and usually longer than the lower cell, guttulate, (12–) 14–17·5 μm long, 2·5–3·5 μm wide, with four apical cilia up to 12 μm long.

Specimens examined: Christchurch Priory, Dorset, U.K., 5 July 1981, P.M. Kirk 985, IMI 260640; Rayleigh, Essex, U.K., 5 July 1981, B.M. Spooner, IMI 261110; Lymington, Dorset, U.K., 10 July 1981, P.M. Kirk 1026, IMI 260813; Castell, Powys, U.K., 11 July 1981, R.W.G. Dennis, IMI 261123; East Lulworth, Dorset, U.K., 12 July 1981, P.M. Kirk 1046, IMI 260937.

The collections on *L. nobilis* leaves cited above differ slightly from those on the usual host, *Quercus ilex* L. leaves, in the slightly larger dimensions of the asci and ascospores. Ellis (1976) gives the asci as 36–56 x 8–9 μm and the ascospores as 11–14 x 2·5–3·5 μm. However, the shape of the ascospores and the position of the cilia are identical in specimens from both sub-

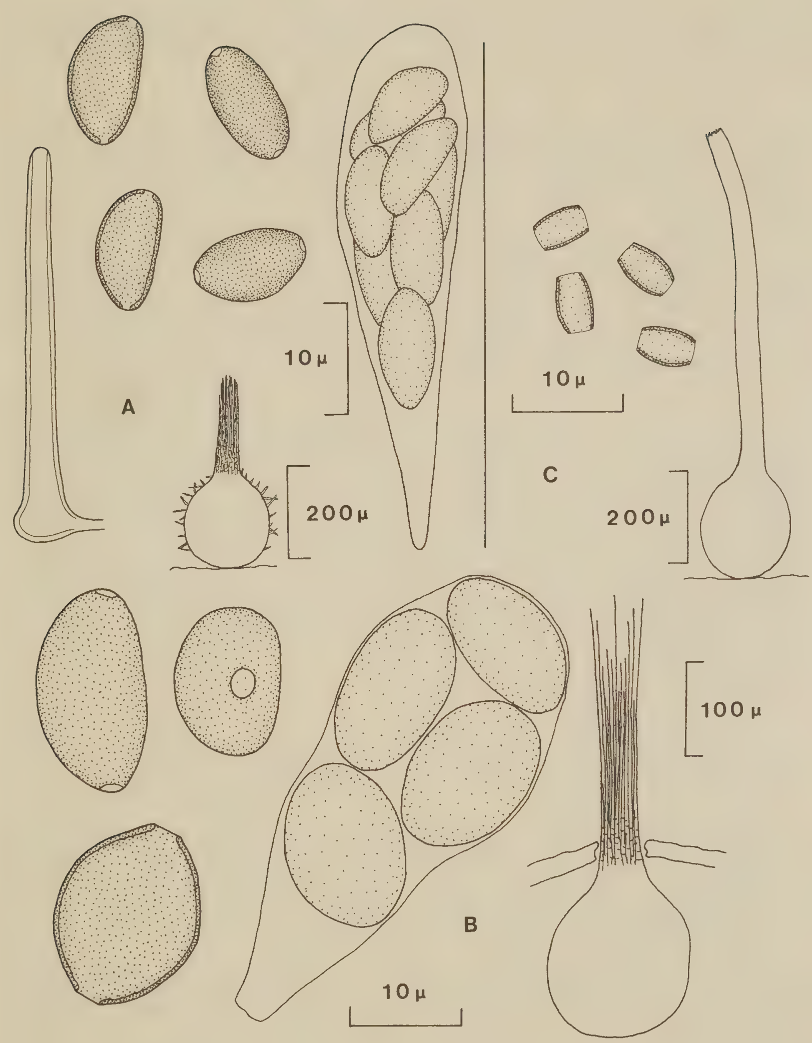
A
10 μ
200 μ
C
10 μ
200 μ
100 μ
B
10 μ

Fig. 3. (A) *Melanospora chionea.* (B) *Melanospora longisetosa.*
(C) *Syspastospora parasitica.*

strata and the collections on *L. nobilis* are therefore referred to this species.
Illustrations: Ellis (1976).

MICROTHYRIUM LAURI Höhnel, *Sber. Akad. Wiss. Wien, Math.-nat. Kl.*, Abt. 1 **128**: 545 (1919). (Fig. 4B)
Microthyrium lauri Dennis & Spooner, *Kew Bull.* **32**: 131 (1977).

A description and illustration of this species, under the name *M. lauri* Dennis & Spooner (in Dennis, Reid & Spooner, 1977), from a British collection of *L. nobilis* leaves has already been published (Kirk, 1981). The exsistence of the name *M. lauri* Höhnel (1919) was overlooked and the purpose of the following observations is to correct this error.

Höhnel (1919) considered that the species represented by Rabenhorst's Fungi europaei No. 2943 and Roumeguere's Fungi gallici exsiccati No. 2586 and named as *M. microscopicum* Desm. was not Desmazieres' fungus and proposed the name *M. lauri* for it. Rabenhorst's exsiccata consists of fallen leaves ('ad folia delapsa') of *Quercus ilex* ('Quercus ilicis (a.)') and *L. nobilis* ('Lauri nobilis (b.)') whilst Roumeguere's is of *L. nobilis* only. Three examples of Rabenhorst's exsiccata are preserved in herb. K and part (b.) of the one labelled 'Purchd. 1/1886', and illustrated here, is selected as a lectotype for *M. lauri* Höhnel (1919) non Dennis & Spooner (in Dennis, Reid & Spooner, 1977).

MICROTHYRIUM VERSICOLOR (Desm.) Höhnel, *Sber. Akad. Wiss. Wien, Math.-nat. Kl.*, Abt. 1 **119**: 453 (1910). (Fig. 4C)

Ascomata thyrothecioid, orbicular, up to 160 μm diam. *Asci* ellipsoid to obclavate, 25–32 μm long, 7–8·5 μm wide. *Ascospores* ellipsoid, 1-septate, the upper cell broader and somewhat longer than the lower cell, (7–) 8–10 (–13) μm long, 2–3 μm wide, cilia not observed.

Specimens examined: Rayleigh, Essex, U.K., 25 Dec. 1980, B.M. Spooner, IMI 255789; Lyme Regis, Dorset, U.K., 15 July 1981, P.M. Kirk 1104, IMI 261304.

The collections cited above are only tentatatively referred to *Microthyrium versicolor* (Desm.) Höhnel differing from what are here considered to be typical collections, on *Rubus fruticosus* L. agg. stems (in herb. IMI), by their smaller overall dimensions and apparent lack of cilia on the ascospores. However, the present material is rather scant and in poor condition and further collections may confirm the occurrence of *M. versicolor* on *L. nobilis* leaf litter.
Illustrations: Ellis (1976).

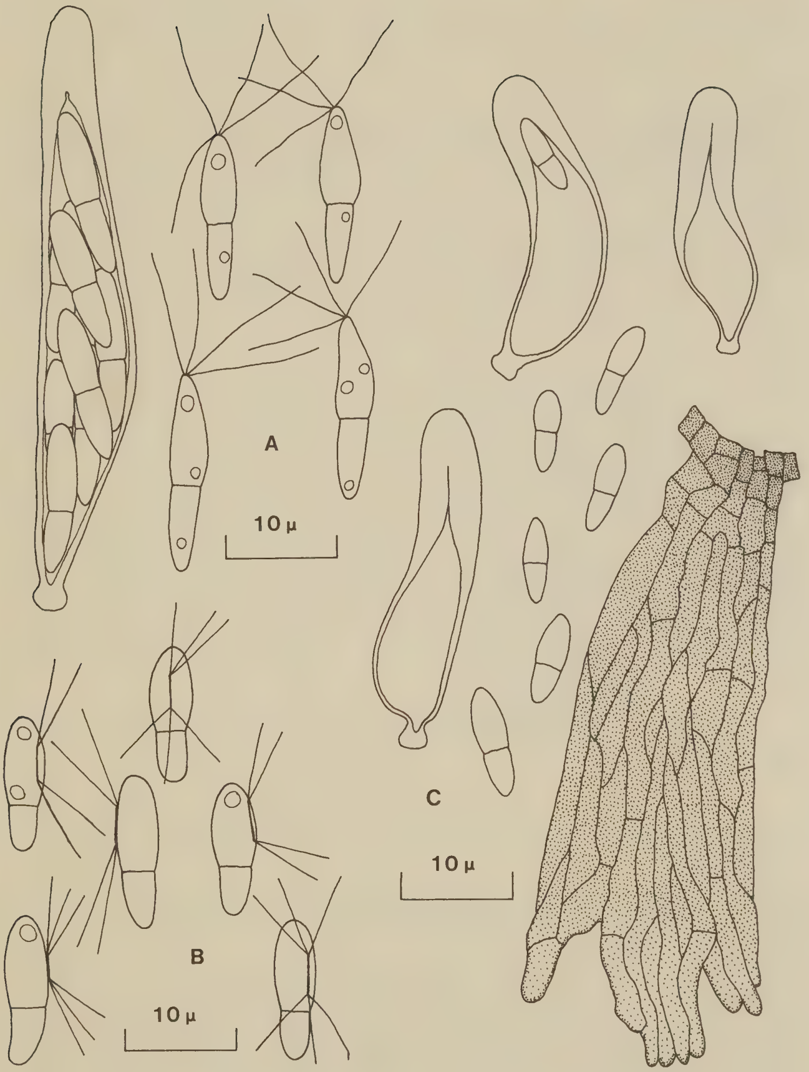
A
10 μ
B
10 μ
C
10 μ

Fig. 4 (A) *Microthyrium ilicinum.* (B) *Microthyrium lauri.*
(C) *Microthyrium versicolor.*

MORENOINA RHODODENDRI J.P. Ellis, *Trans. Br. mycol. Soc.* **74**: 305 (1980). (Fig. 5)

Previously reported from *Laurus nobilis* leaf litter (Kirk, 1981), a second abundant collection of this easily recognized fungus has been made and the opportunity to illustrate the collection and review the determination has been taken. Originally described from dead stems of *Rhododendron ponticum* L. and *Vaccinium myrtilis* L., it is now also known to occur on dead canes of *Rubus fruticosus* agg. and *R. idaeus* L. (herb. IMI, unpubl.). The collections on *L. nobilis* are almost indistinguishable from those referred to above except, perhaps, in their slightly narrower and less pigmented thyrothecia, slightly narrower ascospores, (7–) 7·5–9·5 (–10) x 2·5–3 (–3·5) μm compared with 8–10 (–12) x 3–4 (–4·5) μm, and somewhat larger conidia, (2·5–) 3–4 (–5) x 0·5–1 μm compared with 2–3 x 0·5–1 μm. These differences are not, however, considered significant. The *Sirothyriella* anamorph is particularly common on *L. nobilis* leaf litter and frequently occurs in the absence of the teleomorph.

A further species of *Morenoina* is known from the leaves of a species of *Laurus*. Dennis & Spooner (in Dennis, Reid & Spooner, 1977) described *M. azorica* Dennis & Spooner from leaf litter of *L. azorica* (Saub.) Franco collected on Terceira, Azores. This species differs only slightly (ascospores 6–8 (–9) x 2–2·5 (–3) μm)from *M. rhododendri* and further collections, it is presently known only from the rather scant type collection, may show that the two taxa are conspecific.

Specimen examined: Studland, Dorset, U.K., 9 July 1981, P.M. Kirk 1003, IMI 260615.

NECTRIA ERUBESCENS (Desm.) Phill. & Plowr., *Grevillea* **10**: 70 (1881). (Fig. 6A)

Sphaeria erubescens Desm., *Ann. Sci. Nat., Bot.*, ser 3 **6**: 72 (1846).
Calonectria erubescens (Desm.) Sacc., *Michelia* **1**: 309 (1878).
Anamorph: *Cylindrocarpon* sp.

Ascomata perithecioid, superficial, solitary or rarely in small groups, orange, becoming brownish with age, appearing slightly roughened, globose or somewhat flattened, up to 250 μm diam., collabent when dry. *Asci* clavate, rounded at the apex and lacking any trace of an apical apparatus, 50–70 μm long, 8–10 μm wide. *Ascospores* fusiform, smooth, hyaline, 3-septate, 14–20 (–22) μm long, 3·5–4·5 μm wide. *Phialides* solitary, sessile on the vegetative hyphae, lageniform, 8–24 μm high, 2–3 μm wide. *Conidia* cylindrical with rounded ends, smooth, hyaline, 3-septate, (16–) 18–28 (–32) μm long, 2–3 μm wide.

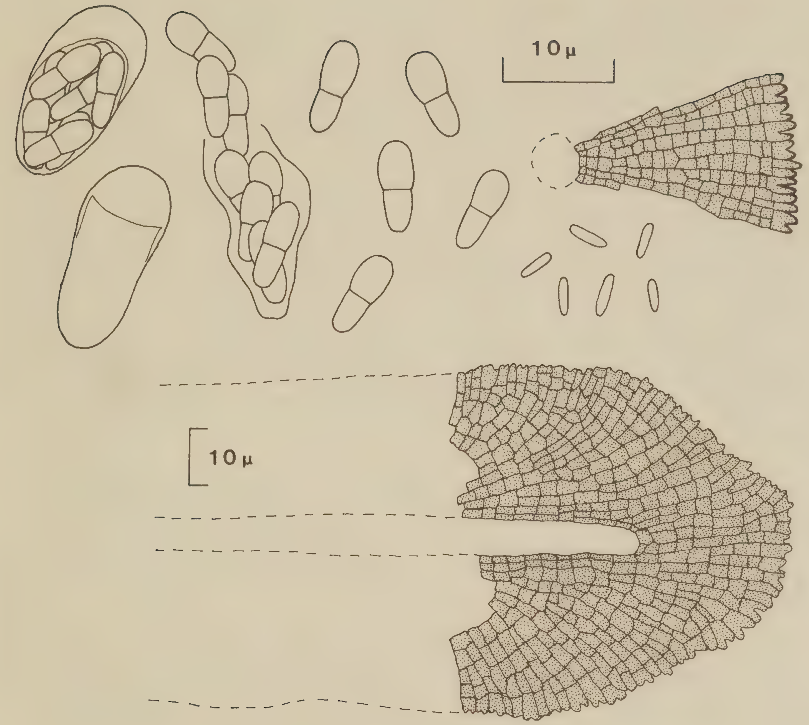

Fig. 5 *Morenoina rhododendri.*

Specimens examined: Fleet Churchyard, Dorset, U.K., 13 July 1981, P.M. Kirk 1053, IMI 260944 (anamorph), 1064, IMI 260955 (teleomorph).

Nectria erubescens (Desm.) Phill. & Plowr. is apparently a rare species in the British Isles, known only from a single collection from the Channel Isles and from three localities in the south and south-west of the mainland (herb. IMI, unpubl.). All collections are, however, on *Ilex aquifolium* L. leaves, the substratum of the holotype, and the present collections, therefore, represent a new host record for the species. Samuels (1978) recorded it from New Zealand on a variety of non-lignified plant debris and it is also known from Bermuda (Samuels, 1978).

Illustrations: Samuels (1978), Weese (1914).

NIESSILIA EXOSPORIOIDES (Desm.) Winter in Rabenhorst, *Kryptogamenfl. Deutsch., Oest. & Schw.* 1(2): 197 (1885). (Fig. 6B)
Venturia nobilis Sacc., *Nuovo G. bot. ital.* 8: 174 (1876).
Anamorph: *Monocillium granulatum* (Fuckel) W. Gams, *Cephalosporium-artige Schimmelpilze* (*Hyphomycetes*): 157 (1971).

Ascomata perithecioid, superficial, dark brown to blackish brown, bearing setae on the upper half, 75–125 μm diam. *Setae* subulate, smooth, straight, dark brown, thick-walled, non-septate, up to 80 μm long, 3–5 μm wide. *Asci* clavate, 8-spored, 25–40 μm long, 4–6 μm wide. *Ascospores* ellipsoid, medianly 1-septate, smooth, hyaline, 7–9 (–10) μm long, 1·5–2 μm wide. *Phialides* solitary, hyaline, erect, straight or slightly flexuous, smooth, septate, thick-walled except at the apex, 40–60 μm high, 1·5–2 μm wide, sometimes slightly swollen below the apex to 2·5 μm wide, occasionally sterile and swollen at the apex. *Conidia* ellipsoid, hyaline, smooth, non-septate, 4–7 μm long, 1–1·5 μm wide.

Specimens examined: Rayleigh, Essex, U.K., 25 Dec. 1980, B.M. Spooner, IMI 255788; Fleet Churchyard, Dorset, U.K., 13 July 1981, P.M. Kirk 1065, IMI 260956; Abbotsbury, Dorset, U.K., 13 July 1981, P.M. Kirk 1081, IMI 260972; Lyme Regis, Dorset, U.K., 15 July 1981, P.M. Kirk 1102, IMI 261302.

In the British Isles *Niesslia exosporioides* (Desm.) Winter appears to be particularly common on dead leaves of *Carex* spp. The closely related *N. exilis* (Alb. & Schwein.: Fr.) Winter, differing from the present species by its larger ascospores and conidia, is frequently encountered on decaying needles of species of *Pinus* (herb. IMI, unpubl.).

Sivanesan (1977) examined the holotype of *Venturia nobilis* Sacc. (1876) but excluded the species from his account of *Venturia* because the holotype was in poor condition and difficult to interpret. However, a recent re-examination of the holotype revealed the presence of proximally thick-walled phialides and similarly thick-walled, sterile, capitate elements associated with the superficial ascomata. It is clear, therefore, that *V. nobilis* and *N. exosporioides* are conspecific, the description of the former species agreeing closely with that of the latter.

Illustrations: Gams (1971).

PHOMATOSPORA BERKELEYI Sacc., *Nuovo G. bot ital.* 7: 306 (1975). (Fig. 7)

Ascomata perithecioid, immersed, globose, ostiole perforating the epidermis and appearing as minute black discs on the outer surface. *Asci* cylindrical, thin-walled, shortly stipitate, with a small refractive ring at the apex, 8-spored,

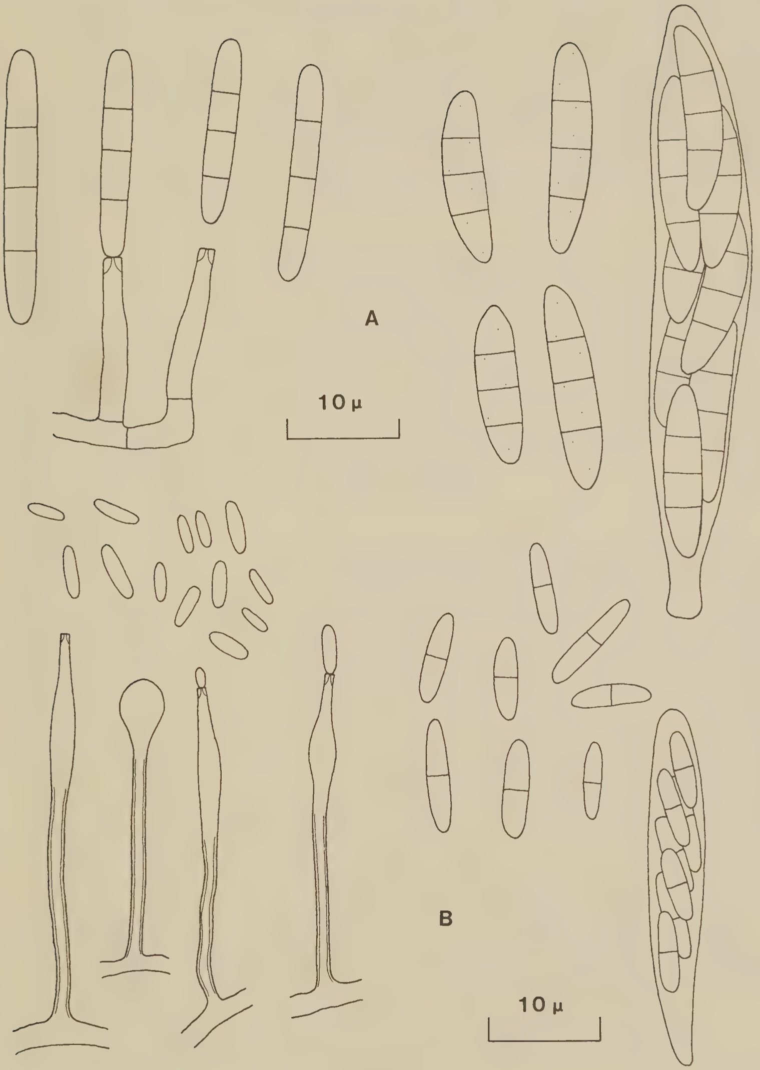

Fig. 6. (A) *Nectria erubescens*. (B) *Niesslia exosporioides*.

60–90 µm long, 3–4·5 µm wide. *Ascospores* uniseriate, non-septate, hyaline to very pale brown, pale brown in mass, ellipsoid with abruptly truncated ends or somewhat elongate doliiform, appearing striate due to narrow, lateral, longitudinal ridges which are sometimes bifurcate, end faces appearing smooth, 6–8·5 µm long, 2–2·5 µm wide.

Specimens examined: Studland, Dorset, U.K., 9 July 1981, P.M. Kirk 1004, IMI 260616; Lymington, Dorset, U.K., 10 July 1981, P.M. Kirk 1027, IMI 260814; Abbotsbury, Dorset, U.K., 13 July 1981, P.M. Kirk 1082, IMI 260973; Lyme Regis, Dorset, U.K., 15 July 1981, P.M. Kirk 1103, IMI 261303; St. Richards Church, Slindon, Sussex, U.K., 3 Apr. 1982, P.M. Kirk 1169, IMI 266766.

Originally described from leaves of *Solanum tuberosum* L. (Dennis, 1978), Hawksworth (1976) recorded it from dead canes of *Phragmites* sp. Additional records from the British Isles are *Dactylis glomerata* L., *Deschampsia caespitosa* (L.) Beauv., *Elymus arenarius* L. and *Phragmites australis* Trin. ex Stued. (herb. IMI, unpubl.).

The true nature of the ornamentation on the ascospore wall does not appear to have been previously reported.

SYSPASTOSPORA PARASITICA (Tul.) P. Cannon & D. Hawksw., *Bot. J. Linn. Soc.* 84: 152 (1982). (Fig. 3C)
Melanospora parasitica (Tul.) Tul. & C. Tul., *Selecta Carpologia Fungorum* 3: 10 (1865).

Ascomata perithecioid, superficial, globose to pyriform, 200–300 µm diam., beak 450–800 µm long, 30–50 µm wide. *Asci* rapidly evanescent, not seen. *Ascospores* cylindrical to somewhat doliiform, pale brown to brown, smooth, with two polar pores 1–2 µm diam., 4–6 µm long, 2–3 µm wide.

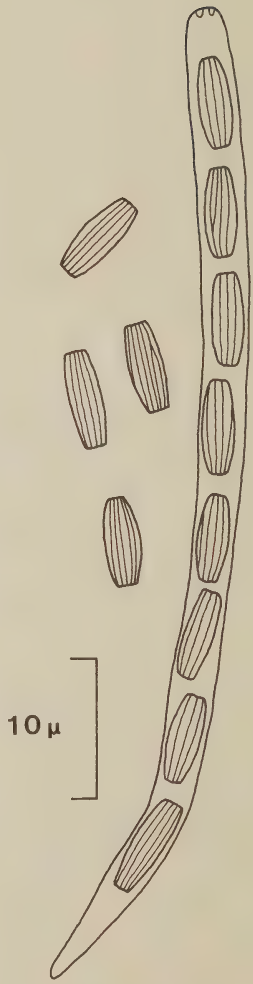

Fig. 7.

Phomatospora berkeleyi.

Specimen examined: Wheatfen Broad, Norfolk, U.K., 24 Aug. 1981, M.B. & J.P. Ellis, IMI 261548.

In the present collection the ascomata are located on the inrolled margin of the leaf where the fungus is presumably growing parasitically on a species of *Isaria* or some other entomogenous fungus, the usual host of *S. parasitica*, which has infected the insect responsible for the leaf curling.

Illustrations: Cannon & Hawksworth (1982), Doguet (1955).

ACKNOWLEDGEMENTS

The author is indebted to Dr. R.W.G. Dennis, Dr. M.B. Ellis and B.M. Spooner for making collections of *Laurus nobilis* leaf litter, the Directors herb. K and herb. PAD for permission to examine collections in their keeping, to Dr. A. Sivanesan and B.M. Spooner for examining some of the collections cited, and to Dr. B.C. Sutton for reviewing the manuscript.

REFERENCES

ARX, J.A. VON & MÜLLER, E. (1954). Die Gattungen der Amerosporen Pyrenomyceten. *Beitrage zur Kryptogamenflora der Schweiz* **11** (1), 1–434.

CANNON, P.F. & HAWKSWORTH, D.L. (1982). A re-evaluation of *Melanospora* Corda and similar Pyrenomycetes, with a revision of the British species. *Botanical Journal of the Linnean Society* **84**, 115–160.

DENNIS, R.W.G. (1956). A revision of the British Helotiaceae in the Herbarium of the Royal Botanical Gardens, Kew, with notes on related European species. *Mycological Papers* **62**, 1–216.

DENNIS, R.W.G. (1978). *British Ascomycetes*. Lehre: J. Cramer.

DENNIS, R.W.G., REID, D.A. & SPOONER, B.M. (1977). The fungi of the Azores. *Kew Bulletin* **32**, 85–136.

DOUGET, G. (1955). Le genre *Melanospora. Le Botaniste* **39**, 1–313.

ELLIS, J.P. (1976). British *Microthyrium* species and similar fungi. *Transaction of the British Mycological Society* **67**, 381–394.

GAMS, K.W. (1971). *Cephalosporium-artige Schimmelpilze (Hyphomycetes)*. Stuttgart: Gustav Fischer.

GOLA, G. (1930). *L'Erbario Micologico di P.A. Saccardo*. Padova.

HAWKSWORTH, D.L. (1976). The Natural History of Slapton Ley Nature Reserve. X. Fungi. *Field Studies* **4**, 391–439.

HÖHNEL, F.X.R. VON (1919). Fragmente zur Mykologie Nr. 1159. Uber die Gattung *Microthyrium* Desmazieres. *Sitzungsberichte der Akademie der Wissenschaften in Wien. Mathematisch-naturwissenschaftliche Klasse*, Abt. 1 **128**, 542–555.

KIRK, P.M. (1981). New or Interesting Microfungi. III. A preliminary account of the Microfungi colonizing *Laurus nobilis* leaf litter. *Transactions of the British Mycological Society* 77, 457–473.

KIRK, P.M. (1982). New or Interesting Microfungi. V. Microfungi colonizing *Laurus nobilis* leaf litter. *Transactions of the British Mycological Society* **78**, 293–303.

KIRK, P.M. (1983). New or Interesting Microfungi. X. Hyphomycetes on *Laurus nobilis* leaf litter. *Mycotaxon* **18**, 259–298.

KORF, R.P. & KOHN, L.M. (1980). Revisionary studies in the Hyaloscyphaceae. I. On genera with "glassy" hairs. *Mycotaxon* **10**, 503–512.

MORDUE, J.E.M. (1971). *Glomerella cingulata*. Commonwealth Mycological Institute Descriptions of Pathogenic Fungi and Bacteria No. 315.

SACCARDO, P.A. (1875). Fungi Veneti novi vel critici. Series II. *Nuovo giornale botanico italiano e Bolletino della Societa botanico italiana* 7, 299–329.

SACCARDO, P.A. (1876). Fungi Veneti novi vel critici. Series V. *Nuovo giornale botanico italiano e Bolletino della Societa botanico italiana* 8, 161–211.

SAMUELS, G.J. (1978). Some species of *Nectria* having *Cylindrocarpon* imperfect states. *New Zealand Journal of Botany* **16**, 73–82.

SIVANESAN, A. (1977). *The Taxonomy and Pathology of Venturia species*. Bibliotheca Mycologica 59. Vaduz: J. Cramer.

WEESE, J. (1914). Beitrag zur kenntnis der Gattung *Calonectria*. *Mycologisches Centralblatt* **4**, 121–132.

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CYLINDRODENDRUM ALBUM BONORDEN

A PLEOANAMORPHIC SEMIAQUATIC HYPHOMYCETE

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SUMMARY

Cylindrodendrum album Bonorden, rediscovered on *Populus* leaves in a forest stream in Belgium, is redescribed. The hyphomycete is phialidic with one-septate cylindrical conidia. In culture and according the conditions, it develops another form of phialides and conidia which are considered characterizing a distinct anamorph belonging to *Cylindrocarpon* Wr. and named *C. hydrophilum* Buffin & Hennebert anam. nov.

INTRODUCTION

In 1851, Bonorden described the genus *Cylindrodendrum* with two new species, *C. album* and *C. articulatum*. Neither of those species has been recorded nor redescribed since 1851. Bonorden's original description and illustration of *Cylindrodendrum album* are reproduced in this paper (Fig. 3). The original collections which should typify the two species appear to be nonexistent.

From a stream in a mixed forest of *Populus*, *Alnus* and *Salix* we found a hyphomycete species matching the Bonorden's description and illustration of *Cylindrodendrum album* on immersed and decaying *Populus* leaves subsequently kept with water in Petri dishes in the Laboratory for 2 or 3 days at 20° C. After that period of time the fungus appeared on the emergent parts of the leaves as small white tufts of hyphae producing conidia. Conidia of the same fungus were also observed in the water collected from the stream. Stream water and conidial suspension from the leaf material were spread out on MYA 1% and DYAA 1% culture media[+]. Single conidia from these mass conidial cultures were transfered onto MYA 4% and DYAA 1% culture media. The fungus developed much sooner from mass conidial cultures than from single-conidium cultures. In mass conidial cultures and in single-conidium cultures on media containing 1% sugar the fungus produced the same morphological characters as those observed on the leaves and was referrable to *Cylindrodendrum album*. In single-conidium cultures with more than 1% sugar, the fungus at first showed growth characters of mycelium, conidiophores and conidia similar to those of *Cylindrocarpon* Wr. followed much later by typical conidial structures of *Cylindrodendrum album*. Those two forms of growth in the same fungus are obvious and distinct, although sometimes developed side by side in culture. They are thus considered anamorphs of one fungus, assigned to *Cylindrodendrum* Bon. and to *Cylindrocarpon* Wr. respectively and are described separately.

REDESCRIPTION OF *CYLINDRODENDRUM ALBUM* BON.

Cylindrodendrum album Bon. in Handb. allgem. Mykologie, p.98, tab. 5, fig. 127, 1851 (Fig. 1, Fig.2 a,b,c).
= *Cylindrophora fagi* Oudem. var. *candida* Bres. in Annls mycol. 13:106, 1915 (type in Herb. S).
≡ *Pseudomicrodochium candidum* (Bres.) de Hoog, in Persoonia 10:71, 1978.

Colonies on leaves and in mass conidial cultures on DYAA 1% white, mostly superficial with prostrate,hyaline,septate, fasciculate, 3-6 µm in diameter hyphae, reverse becoming brown,forming aerial, white, small, arbuscular, 0.5-2 mm high tufts of branched fertile hyphae. *Conidiophores* erect, in tufts or single from the prostrate hyphae, snow white, undulating, apparently verrucose (the apparent verrucosity of the conidiophores and phialides is due to minute droplets of hydrophobic and acidosoluble clear exudate), bush-like, branched, septate, 500-1500 x 3-5 µm, producing, at first from the base, lateral phialides disposed at irregular intervals, often just below the septa, bearing conidia in masses, with the tips of branches at first sterile, 50 µm long or more, diversely curled or undulate and late becoming fertile.

[+] MYA 1%, 2%, 4% = 1%, 2%, 4% malt agar with 0.3% yeast extract. DYAA 1% = 1% dextrose, 0.3% yeast extract, 0.1% asparagine, salts, agar.

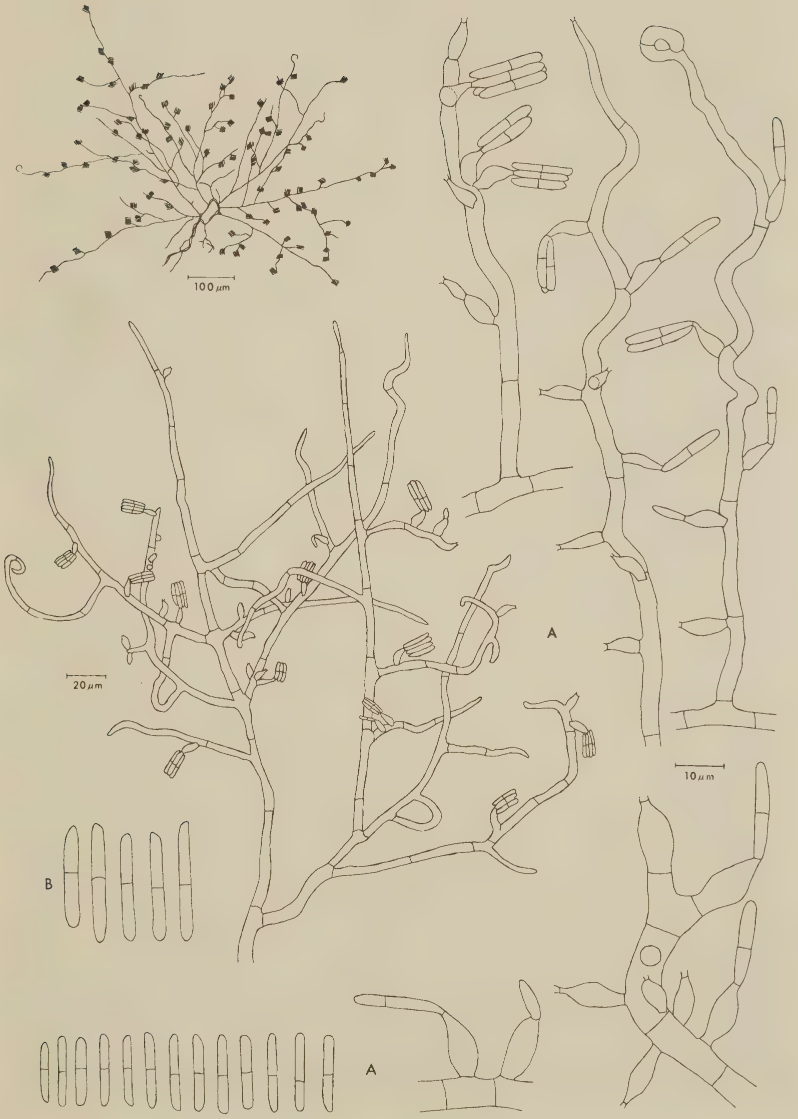

100 µm
A
20 µm
10 µm
B
A

Fig. 1. *Cylindrodendrum album* Bon. from neotype material (Herb. MUCL 28016-A). A, conidiophores and conidia on DYAA1%, B, conidia on PDA 2% at pH3.

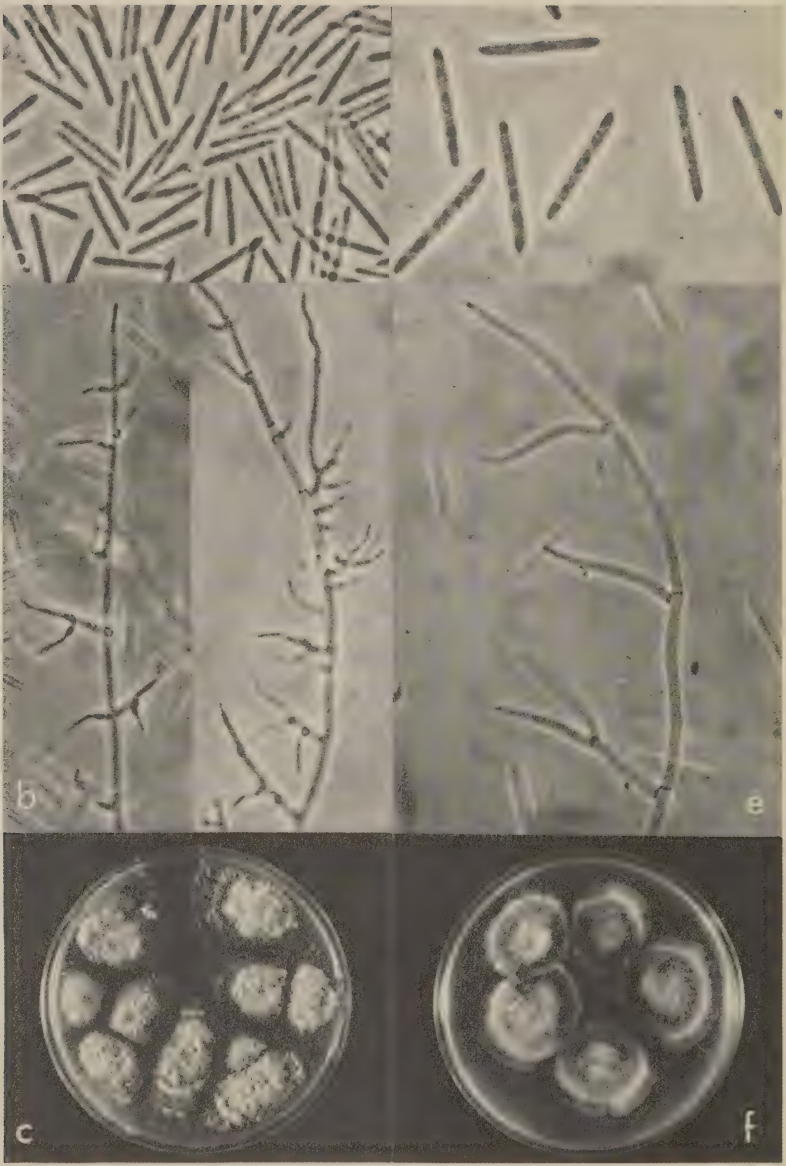


Fig. 2. a,b,c. *Cylindrodendrum album* Bon., conidia (x750), conidiophores (x400) and colonies on DYAA 1%; d, e, f. *Cylindrocarpon hydrophilum* Buffin & Hennebert, conidia (x750), conidiophores (x400), colonies on MYA 4% (MUCL 28016).

Conidiogenous cells phialides, lateral or terminal, arising mostly singly or by twos or threes in verticils, oriented at a right angle or nearly so, flask-shaped, constricted at the base, with a basal septum, abruptly attenuated at the apex, apparently verrucose, 10-12 x 3.5-6 µm, with a 1.5-2 µm wide collarette. *Conidia* enteroblastic, hyaline, straight, strictly cylindrical, rounded at the apex, asymetrically pointed at the base, smooth and mucilaginous, often produced obliquely at the apex of the phialide and remaining agglutinated in small fasciate masses, at first continuous, one-septate at maturity, 12-18 x 2-2.5 µm. No chlamydospores observed.

Holotype: no original material known. As iconotype, fig. 127 in Bonorden, Handb. allgem. Mykologie, tab. 5, 1851 (Fig. 3).

Neotype: on decaying *Populus* leaves and on DYAA 1% culture medium, from the Lauzelle Forest, Louvain-la-Neuve, Belgium, coll. Nathalie Buffin, November 12, 1982, in MUCL Herbarium (MUCL 28016-A). Living culture from the neotype: MUCL 28016.

Other collections: (1) MUCL 28022 and 28053, same data as the neotype, in herbarium and culture collection. (2) Holotype material of *Cylindrophora fagi* Oudem. var. *candida* Bres. 'an faulenden Aesten und Nadeln von Pinus silvestris bei Königstein, Juli 1914', Germany, coll. W. Krieger, det. J. Bresadola in Herb. S (Fig. 4). (3) IMI 31461, *Cylindrodendrum album* Bon. on *Aesculus hyppocastanum* Swinton Park, Yorks., Great Britain, coll. and det. S. J.Hughes, 26.9.1948, from Herb. S. (4) CBS 912.73 as *Uncigera cordae*.

TAXONOMIC POSITION OF *CYLINDRODENDRUM* BON. AND GENERA WITH WHICH IT MAY BE CONFUSED

The segregation of *Cylindrodendrum* Bon. is made from the related genera *Ceratocladium* Corda, *Cylindrotrichum* Bon., *Cylindrium* Bon., *Septocylindrium* Bon. ex Sacc., *Cylindrophora* Bon., *Uncigera* Sacc., *Pseudomicrodochium* Sutton and *Trichoderma* Pers.

Bonorden's original generic and specific descriptions are as follows:

"*Cylindrodendrum* Bonorden.

Baumförmig verzweigte Hyphen haben am Stamm und den primären Aesten kleine ovale Aestchen, aus diesen treten zylindrische Sporen einzeln hervor. Die Spitzen der sekundären Aeste sind unfruchtbar.

1. *Cylindrodendrum album*, Fig. 127, mit weissen septirten Hyphen und zylindrischen abgerundeten Sporen. Die Spitzen der Aeste sind gekrümmt. Bildet auf modernden Zweigen kleine wollige Häufchen und ist eine weitere Entwickelung von *Ceratocladium*.

2. *Cylindrodendrum articulatum*, mit in Stamm stark articulirten Zellen und geraden spitzen unfruchtbaren Endästen. Bildet kleine weisse Polster."

Bonorden classified the genus *Cylindrodendrum* in his fifth family of the Hyphomycetes, the *Dendrini*, characterized, as he said, by dendriform or bush-like branched fertile hyphae bearing spores acrogenously and, eventually, repetitively and often with sterile ends, while spore septation and grouping on the conidiferous hyphae was considered a generic character.

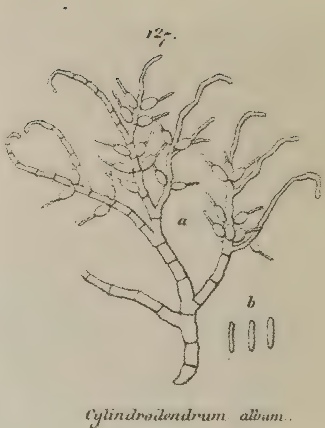


Fig. 3. Cylindrodendrum album after Bonorden (1851)

The only original illustration, that of *C. album* (Fig. 3), shows well the generic characters described. *C. album* has been chosen as lectotype species by Clements and Shear (1931) and is accepted as such (Kendrick & Carmichael 1973).

The fungus described here above as *C. album* shows exactly the same habit and morphology that the one described and illustrated by Bonorden, i.e. small white tufts of dendroid conidiferous hyphae, the branches of which are often undulate to recurved and sterile at their ends, bearing cylindrical straight conidia on lateral inflated phialides ('ovale Aestchen'). No authentic material being known for *C. album* Bon., we thus designate one of our collections, MUCL 28016-A as neotype for the species.

Cylindrodendrum articulatum Bon. is not recognisable yet. No authentic material is known. No illustration was given by Bonorden.

The only later species assigned to *Cylindrodendrum* is *C. suffultum* Petch in Trans. Br. myc. Soc. 27:91, 1944. It was found on small puppa of Diptera in Britain and is actually a phyalidic hyphomycete with catenate conidia (contrary to Petch's observation) as we have observed for the type material in Herb. K and IMI 52309. The species has been redisposed as *Paecilomyces suffultus* (Petch) Samson in Mycol. Stud. Baarn, 6:55, 1974.

Ceratocladium Corda, Prachtflora p. 41, 1840.

Type species, *C. microspermum* Corda, ibidem.

Bonorden distinguished *Cylindrodendrum* from *Ceratocladium* by its developing a larger colony. Indeed, *Ceratocladium* produces only small groups of a few conidiophores.

Both *Ceratocladium* and *Cylindrodendrum* have branched conidiophores with sterile ends and phialidic cylindrical conidia. But *Ceratocladium* differs from *Cylindrodendrum* by its obsolete conidiophore with a mononematous stipe ending in sterile apical branching spreading over the colony, while *Cylindrodendrum* conidiophores are branched from the base, their sterile ends pointing out through the tuft.

Cylindrotrichum Bon. in Handb. allgem. Mykologie, p. 88, 1851.
Lectotype species (Hughes 1958), *C.oligospermum* (Corda) Bon.
≡ *Menispora oligosperma* Corda, Icones fung. II, p. 12, fig. 55, 1838. (type in PR Herb.).
= *Acrothecium delicatulum* Berk. & Br. (holotype in Herb. K).

The genus was described, and *Cylindrotrichum album* Bon. illustrated, with mononematous conidiophores and cylindrical, lateral conidia. The conidia are actually phialidic, borne at the apex of the phialide but become lateral following the proliferation of the phialide (polyphialide), as illustrated by Barron (1968) and Carmichael and al. (1980).

Fusidium Link in Mag. Ges. naturf. Freunde, Berlin, 3:8, 1809.
Lectotype species (Hughes 1958), *F. griseum* Link ibidem.
= *Cylindrium* Bon. in Handb. allgem. Mykologie, p. 34, 1851.
Lectotype species (Hughes 1958), *Fusidium aeruginosum* Link, in Mag. Ges. naturf. Freunde, Berlin, 3:8, 1809.
= *Fusidium flavovirens* Ditm. in Sturm's Deutschl. Flora III, 1 (2):37, 1814.
≡ *Cylindrium flavovirens* (Ditm.) Bon. in Handb. allgem. Mykologie, p. 34, 1851.

Bonorden (1851) described the genus *Cylindrium* also as having cylindrical conidia. The conidia are acuminate and continuous,produced in branched chains on a conidiophore reduced to the mothercell. The genus synonymized with *Fusidium* Link (Hughes 1958), obviously differs from *Cylindrodendrum* by its reduced unbranched conidiophores and acropetal chains of continuous conidia.

Bonorden included in the genus another species but with septate, hyaline conidia, *Cylindrium septatum* Bon., and expressed his reluctance to make for it another new genus for which he had considered the name *Septocylindrium*. Saccardo (1877) renamed *Cylindrium septatum* as *Septocylindrium bonordenii* Sacc. and illustrated it in *Fungi italici autographice delineati* n° 75. Its conidia develop in acrogenous chains.

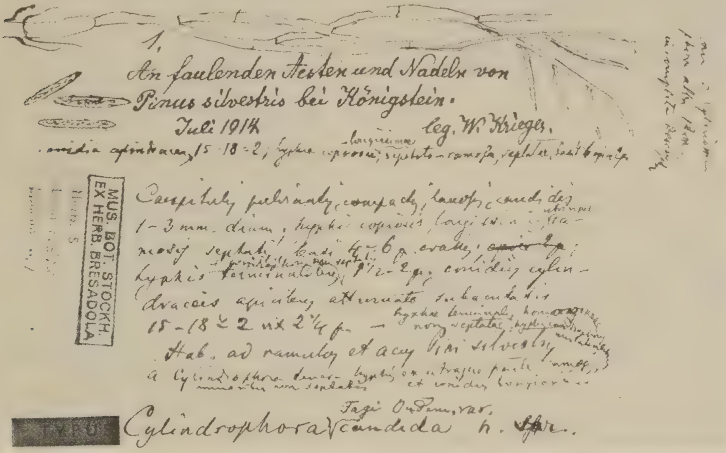
Cylindrophora Bon. in Handb. allgem. Mykologie, p. 92, 1851.
Original species: *C. verticillata* Bon.,*C. alba* Bon., *C. tenera* Bon.

Bonorden published yet another genus with cylindrical conidia in the family *Pleurosporiacei*. He characterised the genus by branched conidiophores with, at right angle, lateral, sometimes furcate conidiogenous (probably phialidic) fertile branches and cylindrical conidia . No exact features are known of the three species included in Bonorden. De Hoog (1978) considers the genus as doubtful, suggesting that *C. verticillata* (≡ *Verticillium cylindrosporum* Corda, not '*cylindrophorum*' as cited by Bonorden) may be *Verticillium fungicola* (Preuss) Hasserbr., *Cylindrophora alba* close to *Cladobotryum apiculatum* (Tubaki) W. Gams & Hoozem. and *Cylindrophora tenera* (selected by Clements & Shear (1931) as type species) close to *Acremonium strictum* W. Gams.

Oudemans (1903) described *Cylindrophora fagi* Oud. in Ned. Kruid. Arch. 3 (1):900, 1903. No type specimen exists, but the original and published drawing by the collector C. J. Koning is preserved in Oudemans's herbarium in Leiden Herbarium. From the description and the illustration, it is not possible to decide whether the conidia are phialidic or not. The assignment of the species to *Cylindrophora* was tentative only, Oudemans having had no idea of what Bonorden's species of *Cylindrophora* could be.

Bresadola (1915) described another taxon, collected by W. Krieger on twigs and needles of *Pinus sylvestris* near Königstein, Germany, which he considered at first to be a new species of *Cylindrophora* close to *C. alba* Bon., but later to be a new variety of *C. fagi* Oudem., named *C.fagi* var. *candi-*

da Bres. The holotype (Herb. S) (Fig. 4) has been found identical with *Cylindrodendrum album* Bon. The collection has been distributed in the Krieger's *Fungi Saxoni exsiccati*, under the same name. De Hoog (1978) transfered the variety to *Pseudomicrodochium* Sutton.



1,

An faulenden Aesten und Nadeln von
Pinus silvestris bei Königstein.
Juli 1914 leg. W. Krieger.

MUS. BOT. STOCKH.
EX HERB. BRESADOLA

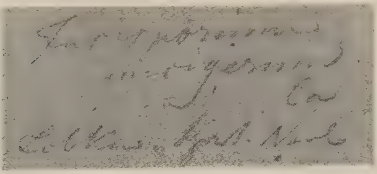
Hab. ad ramulos et acus Pini silvestris

Cylindrophora fagi Oudem. var. candida n. sp.

Fig. 4. Type specimen label of *Cylindrophora fagi* var. *candida* Bres. (Herb. S)

Uncigera Sacc. in Sacc. & Berl. in Atti Ist. Venet. 6(3):741, 1885.
Type species, *U. uncigerum* (Corda) v. Hoehnel, in Sitzungsber. Kaiserl. Akad. Wiss. Wien, Math. Nat. Kl. 118(1):408, 1909.
≡ *Fusisporium uncigerum* Corda in Icones fungorum 2:10, fig. 47, 1838.
≡ *Uncigera cordae* Sacc. in Sacc. & Berl. in Atti Istit. Venet. 6(3):741, 1885.

Corda (1838) described *Fusisporium uncigerum* as forming small, white colonies on decaying leaves of *Acer campestris* in a public garden in Prague, with intermixed, septate and geniculate conidiophores, the successive cells being inflated in their upper part, bearing short pointed, incurved to uncinate branchlets (phialides), disposed by twos and opposite, producing cylindrical, obtuse, guttulate, non-septate, white conidia. Hughes's slide (DAOM Herb.) from the type in Corda's herbarium in PR Herbarium has been examined. Corda in his illustration (Fig. 5) incorrectly shows the phialides above the septa of the conidiophores. The phialides are arranged actually in verticils of 2 to 4 on a swelling of the conidiophore cells just under each septum, as shown in Fig. 7A drawn from type material in Herb. Corda (PR).



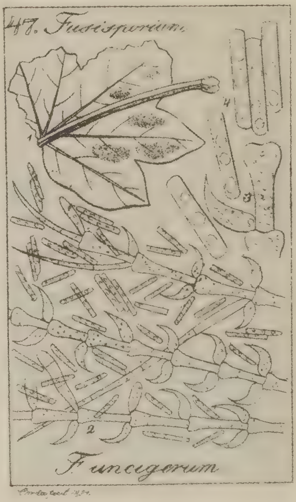

47. Fusisporium
1
2
3
4
F. uncigerum

Fig. 5. Label of the type material of *Uncigera uncigerum* in Corda's Herbarium and Corda's illustration in Icones fungorum 2, fig. 47, 1838.

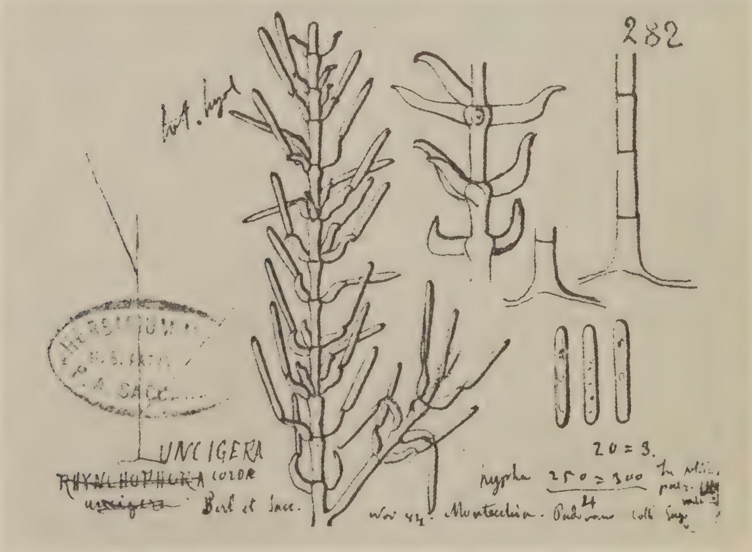

282
UNCIGERA
~~RHYNCHOPHORA~~ CORDA
~~uncigera~~ Berl et Sacc.
20 = 3.
hypha 250 = 300 / 4

Fig. 6. Label of the Saccardo's collection of *Uncigera uncigerum* on *Ulmus*, from PAD Herb.

The same was observed by Saccardo in a specimen collected on decaying leaves of *Ulmus* in November 1884 preserved in PAD Herb. and illustrated in Fig. 6 and 7 B. The conidiophore is erect and may be furcate. The end of a conidiophore has been found sterile.

When describing the genus *Cylindrophora*, Bonorden (1851) mentioned *Fusisporium uncigerum* Corda as a species he would have assigned to that genus if Corda had more clearly shown its conidiogenis. Saccardo (1885) erected the genus *Uncigera* to accomodate the species. Von Hoehnel (1909) corrected the species name into *Uncigera uncigerum* in accordance with the Code of Botanical Nomenclature.

No similarities between *Uncigera* and *Cylindrodendrum* have ever been noticed, but de Hoog (1978) referred to some '*Uncigera*-like' CBS strains which he identified as *Cylindrophora fagi* var. *candida*, without recognizing *Cylindrodendrum album*. Carmichael and al. (1980) reproduced a portion of the de Hoog's illustration of *Cylindrophora fagi* var. *candida* under the name *Cylindrodendrum album*.

Pseudomicrodochium Sutton, in Trans. Br. myc. Soc. 64 (3): 417, 1975.
Type species, *P. aciculare* Sutton, in Trans. Br. mycol. Soc. 64 (3):418, 1975.

Sutton (1975) described and illustrated two original species, *P. aciculare* and *P. cylindricum*, the type of which (Herb. IMI 169711 and 171183) have been examined. The genus is characterized by conidiophores reduced to single or grouped phialides on prostrated hyphae producing one-septate, in the former species, acicular, in the later one, cylindrical conidia. De Hoog (1978) transferred the species *Cylindrophora fagi* var. *candida* to the genus as *Pseudomicrodochium candidum*. But the presence of an erect branched conidiophore in that fungus makes its redisposition in *Pseudomicrodochium* incorrect.

Trichoderma Pers. in Syn. Meth. Fung. p. 231, 1801.
Lectotype species (Hughes 1958), *T. viride* Pers. ibidem.

A white species of the genus, *Trichoderma sporulosum* (Link) Hughes, similar to the green-spored species *T.hamatum* (Bon.) Bain., has undulate sterile tips of the branched conidiophores emerging above the sporodochium surface, an habit very similar to that of *Cylindrodendrum albvm* Bon. in a young stage of development. The conidia differ in shape, however.

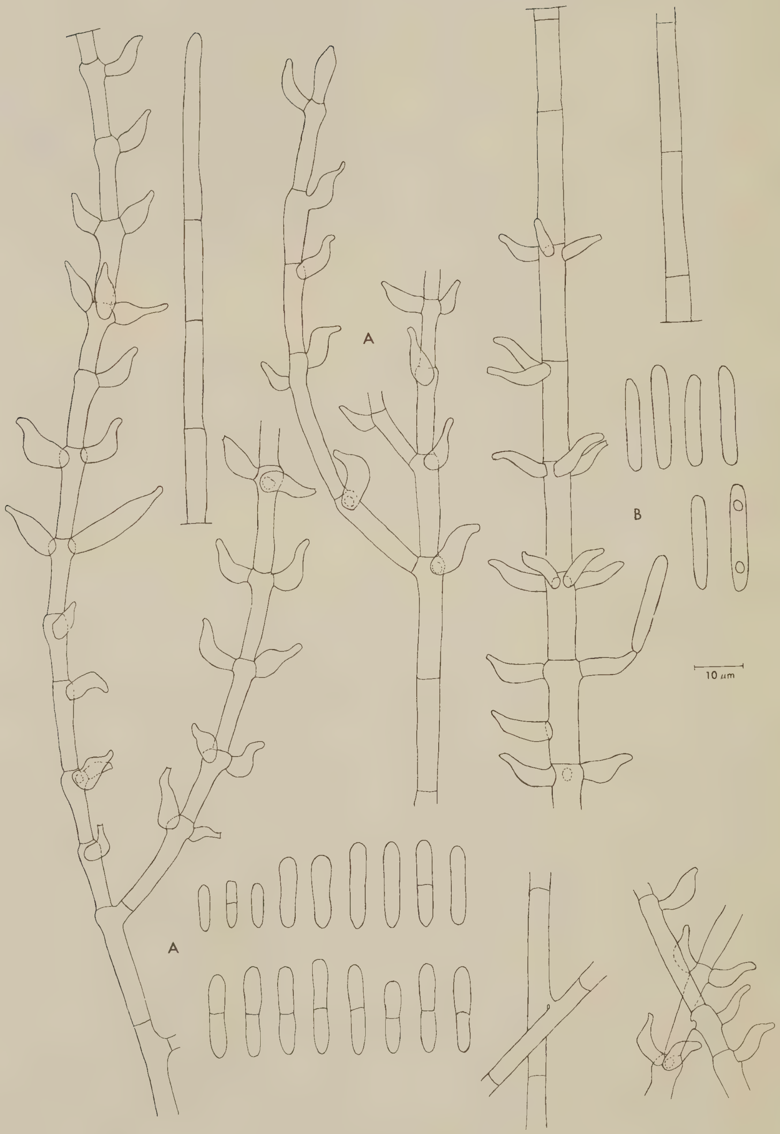


Fig. 7. *Uncigera uncigerum* (Corda) v. Hoehnel, A. from the type material of *Fusisporium uncigerum* Corda in Herb. PR, B. from Saccardo's collection of *Uncigera cordae* Sacc. in Herb. PAD.

DESCRIPTION OF THE *CYLINDROCARPON* SYNANAMORPH

Cylindrocarpon hydrophilum Buffin & Hennebert, spec. anam. nov. (Fig. 2 d, e, f, 8).
Synanamorph.: *Cylindrodendrum album Bon.*

Coloniae in maltoso-agaro effusae, lanosae, zonatae, pallide ochraceae vel fulvae, albido margine, inverso ochraceae, castaneo-brunnae usquead nigrae. *Hyphae* aeriae longae, flexuosae, singulae vel fasciculatae, subhyalinae, laeves sed exsudato ornatae, septatae, ramosae; prostratae vel immersae paucis inflatis cellulis praeditae. *Conidiophora* erecta, irregulariter vel opposite ramosa, 2.5-3.5 µm diam., 30-200 µm longa, hyalina vel subhyalina, laevia sed exsudato ornata, cum lateralibus et terminalibus phialidibus ad septa praedita. *Cellulae conidiogenae* phialides, singulae vel oppositae, tenuae, longae, (10-)19-22.5(-35) x 2.5-3.5 µm, laterales obliquae, fere incurvatae, terminales rectae, basali septo praeditae, apicaliter attenuatae, cum 1-2 µm lato collario, laeves sed exsudato ornatae. *Conidia* enteroblastica, cylindrica, recta, in apice rotundata, basim asymetrica et appiculata, hyalina, laevia, mucosa, guttulata, 2-3-septata, in fasciatis massis ennata, (17-)20-32(-45) x 2.5-3.5(-4) µm. Chlamydosporae nullae.

Habitat in putrescentibus foliis *Populi* in aqua in sylvis.
Holotypus: MUCL 28016-B, ut cultura dessicata in agaro, e Lauzelle sylva, Lovania Nova, Belgica.

Colonies in culture on MYA 2%, 4% or 8%, pale ochraceous to fulvous or buff, with a whitish margin, effuse, lanose, zonate, with aerial hyphae often fasciculate, smooth or apparently verrucose (exudates), long, flexuous, septate, becoming branched and conidioferous, immersed or creeping hyphae hyaline to yellow brown, septate, frequently fasciculate, 2-5 µm in diameter, with few intercallary or terminal swellings, thin-walled, concolorous, sometimes delimited by a septum at one side, reverse pale ochraceous to zonately and radially chesnut brown. *Conidiophores* erect, straight, irregularly branched, 2.5-3.5 µm in diameter, of variable length (30-200 µm), smooth-walled, sometimes apparently verrucose (exudates), hyaline to subhyaline, with main and secondary branches bearing lateral phialides singly or by twos in verticils disposed just under the septa or terminal phialides, the ends of branches not being sterile. *Conidiogenous cells* phialides, slender or long, (10-)19-22.5(-35) x 2.5-3.5 µm, the lateral oriented at a small angle (10-45°) from the conidiophore, the terminal straight, slightly inflated or not at the base above the basal

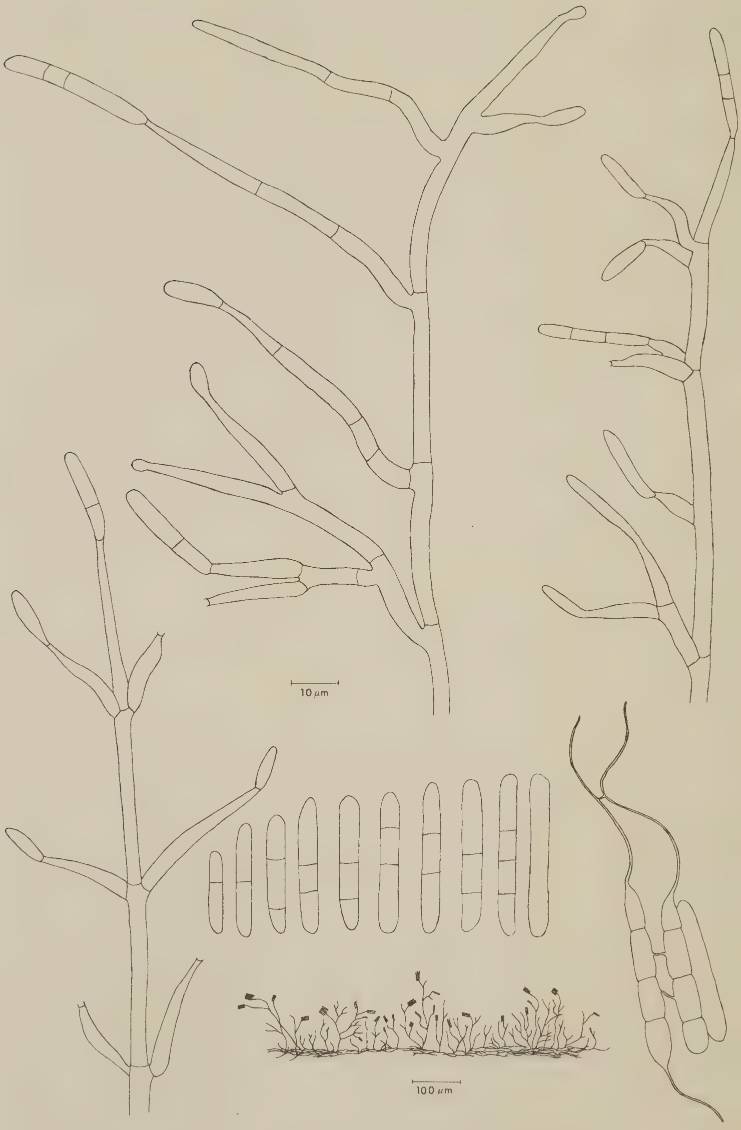


Fig. 8. *Cylindrocarpon hydrophilum* Buffin & Hennebert, from type material on MYA 4% (Herb. 28016-B).

septum, mucilaginous, internally guttulate, at maturity 2-3 septate, often obliquely produced and remaining in a fasciate cluster at the end of the phialide, (17-)20-32(-45) x 2.5-3.5(-4) µm. Germinating conidia inflated, producing a germ at both ends and from each cell or, when close to each other, anastomosing with each other. No chlamydospores observed.

Holotype: dried cultures on MYA 4% and 8%, isolated from *Populus* leaves in stream, Lauzelle Forest, Louvain-la-Neuve, coll. Nathalie Buffin, November 12, 1982, in MUCL Herbarium (MUCL 28016-B). Living culture from the type:MUCL 28016.

Other collections: (1) MUCL 28022 and 28053 same data as the type, in MUCL Herb. and culture collection. (2) CBS 912.73 as *Uncigera cordae*.

This anamorph, *Cylindrocarpon hydrophilum*, is named in reference to the ecological habitat of the fungus.

TAXONOMIC POSITION OF *CYLINDROCARPON HYDROPHILUM*

None of the described *Cylindrocarpon* species matches the *Cylindrocarpon* anamorph of *Cylindrodendrum album* Bon. As far as we know, the closest species are *Cylindrocarpon tenue* Bugn., *C. gracile* Bugn.,*C. curtum* Bugn., *C. orthosporum* (Sacc.) Wr., *C. magnusianum* Wr. and an unnamed species represented by M.F.C. 1857 (Matsushima's strain, but no longer available; Matsushima 1975).

Cylindrocarpon tenue and *C. gracilis* have at the most one-septate conidia, shorter in *C. tenue* on shorter phialides and with numerous chlamydospores, somewhat longer in *C. gracile* on much shorter and penicillate phialides with catenate chlamydospores (Booth 1966).

Cylindrocarpon curtum, as seen in the strain M.F.C. 7922 (Matsushima 1980), has shorter, 3-septate conidia (11-27 µm long) on mostly solitary phialides and produces graying brown colonies. *C. orthosporum* produces smaller, 3-septate conidia (16-26 x 1.5-3 µm) on simple phialides (Booth 1966).

Cylindrocarpon magnusianum, as seen in the strains MUCL 3652 and 28069 (=CMI 113894) and *Cylindrocarpon sp.* M.F.C. 1857 are perhaps the closest taxa, having 3-septate conidia of a similar length but somewhat wider and produced, in the former taxon, on shorter, simple or rarely branched phialides and, in the latter, on longer phialides forming compact sporodochia. *C. magnusianum* also forms chlamydospores.

In our fungus the *Cylindrocarpon* anamorph is characterized by distinctly longer, 2-3-septate conidia, while the *Cylindrodendrum* anamorph produces short, 1-septate conidia.

PLEOANAMORPHY AND CULTURE CONDITIONS

The first growth obtained by culturing a conidial suspension from natural leaf material on MYA 1% and DYAA 1% produced the *Cylindrodendrum* anamorph, similar to that observed on the semi-immersed leaves.

In subsequent cultures on DYAA 1% and on a sugar-richer medium, MYA 4%, as well in single-conidium cultures, the fungus morphology changed. In mass conidial cultures the conidia originating from the *Cylindrodendrum* anamorph produced, on DYAA 1%, small colonies with white tufts, small conidia and sterile hyphal tips, typical of *Cylindrodendrum album*; on MYA 4% small, effuse and ochre colonies with larger conidia and laking sterile hyphal tips of the *Cylindrocarpon* anamorph were produced. In single-conidium cultures inoculate with *Cylindrodendrum* conidia, an extended zonate colony developed, producing predominantly the *Cylindrodendrum* anamorph on DYAA 1% and the *Cylindrocarpon* anamorph on MYA 4% (Fig. 8).

That morphological duality suggests the existence of two conidial forms in the same fungus. A demonstration of their ontogenic connection was carried out by cross cultures. Conidia of the *Cylindrodendrum* type (15-22 µm long) and of the *Cylindrocarpon* type (25-35 µm long) were transfered on DYAA 1% and both produced a predominant *Cylindrodendrum* colony. The same two types of conidia transfered on MYA 4% produced a predominant *Cylindrocarpon* colony.

These variations in the colony characters and the conidiophores, phialides and conidial shape and size chiefly depend on the sugar concentration in the substrate. Transfers of both conidial types were made to a series of culture media at 1%, 2%, 4% and 8% sugar concentration. On 1% sugar, the colonies are of *Cylindrodendrum album*, white and tufty, becoming zonate with alternately more or less profuse growth. On 2% and 4% sugar, the colonies are zonate, effuse, ochraceous, showing predominant *Cylindrocarpon* colony characters and conidia, but producing later, after 3 or 4 weeks, locally or concentrically, white tufts of *Cylindrodendrum* conidiophores. On 8% sugar, and especially on MYA 8%, after a production of the *Cylindrocarpon* colony, the fungus becomes entirely and concentrically covered by *Cylindrodendrum* tufts after three months. The exhaustion of the sugar concentration in the substrate that time may explain the development of the *Cylindrodendrum* conidiomata on rich culture media.

The acidity of the culture medium is another factor of differentiation. Growing well at pH 7, 5 or 3 on PDA 2%, the colonies are predominantly *Cylindrodendrum* at pH 3 and *Cylindrocarpon* at pH 7.

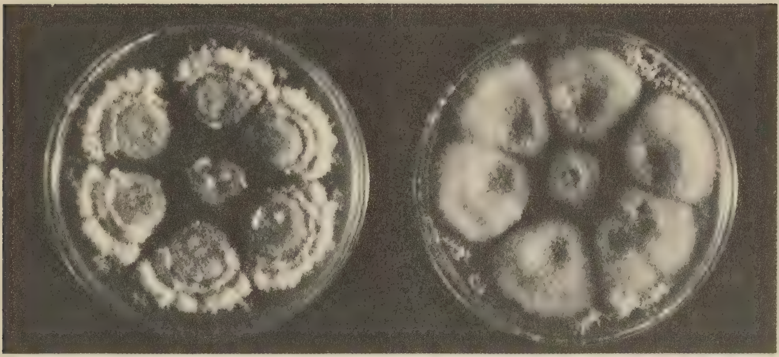


Fig. 9. Strain MUCL 28016, after 3 weeks:(a) on DYAA 1% with predominant *Cylindrodendrum* anamorph, surrounding the central *Cylindrocarpon* form. (b) on MYA 4% with predominant *Cylindrocarpon* anamorph with some marginal *Cylindrodendrum* growth.

Another ecological factor determining the development of the *Cylindrodendrum* conidiophores by this fungus is the presence of water. A thin film of water submerging a mycelial growth of *Cylindrocarpon hydrophilum* on MYA 4% stimulate the development of numerous white tufts of *Cylindrodendrum album* at the water surface. This phenomenon has been previously observed in the semiaquatic hyphomycetes *Spirosphaera beverwijkiana* Hennebert and *S. minuta* Hennebert which produced at the water level typical conidiophores and conidia from the submerged mycelium (Hennebert 1968). The observations reported here suggest that *Cylindrodendrum album* Bon. is to be considered a semiaquatic fungus.

NOMENCLATURAL IMPLICATIONS

Although genetically connected and possibly coexistent in artificial conditions of growth, the *Cylindrodendrum* and *Cylindrocarpon* anamorphs of the fungus are sufficiently distinct to allow the strict application of the present rules for botanical nomenclature approved at the Sydney Botanical Congress in 1981 (Korf 1982). The already accepted distinction between the botanical system of nomenclature of the ascomycetous and the basidiomycetous fungi and an anatomical system of nomenclature for their anamorphs and for anamorphic fungi, as analysed by Hennebert (1971), is now governed by Arts. 3, 7, 11, 13, 25, 34, and 59 after the approval of the nomenclature proposals 11 to 23, 19bis included (Anonym 1979, Vos & Greuter 1981). These rules seem to allow thus the possibility of several nomina anamorphosia for the different anamorphs (or 'synanamorphs') of the same holomorph, when necessary or desirable: 'the priority of nomina anamorphosia' being 'effective only among names typified by similar anamorphs' (Art. 13.6). That rule seems to justify the naming of the *Cylindrocarpon* anamorph of the *Cylindrodendrum album* Bon.

ACKNOWLEDGMENTS

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REFERENCES

ANONYM, 1979 - Nomenclatural Proposals. Subcommittee A. Article 59. Taxon, 28(4): 424-428.
BARRON, G.L., 1968 - The genera of Hyphomycetes from soil. Huttington, 364 p.
BONORDEN, H.F., 1851 - Handbuch der allgemeine Mykologie. Stuttgart, 336 p., 259 fig.
BOOTH, C., 1966 - The genus Cylindrocarpon. Myc. Papers, 104, 56 p., 2 tab.
BRESADOLA, G., 1915 - Neue Pilze aus Sachsen. Annls. Mycol., 13: 104-106.
CARMICHAEL, J.W., W.B. KENDRICK, I.L. CONNERS & Lynne SIGLER, 1980 - Genera of Hyphomycetes. The University of Alberta Press, Edmonton, 386 p.
CLEMENTS, F.E. & C.L. SHEAR, 1931 - The genera of fungi. New York, 496 p. 58 pl.
CORDA, A.C.I., 1838 - Icones fungorum hucusque cognitorum II. Prague, 43 p., tab. 7-15.
DE HOOG, S., 1978 - Notes on fungicolous Hyphomycetes. Persoonia, 10(1): 33-82.
HENNEBERT, G.L., 1968 - New species of Spirosphaera. Trans. Br. mycol. Soc., 51(1): 13-24.
HENNEBERT, G.L., 1971 - Pleomorphism in Fungi imperfecti. in Kendrick, W.B., ed., Taxonomy of Fungi imperfecti. Toronto, p. 202-223.

HUGHES, S.J., 1958 - Revisiones hyphomycetum aliquot cum appendice de nominibus rejiciendis. Can. J. Botany, 36: 727-836.

KENDRICK, W.B. & J.W. CARMICHAEL, 1973 - Hyphomycetes. in Ainsworth, G.C., F.K. Sparrow & A.S. Sussman, The Fungi, vol. IV A, p. 323-509. Academic Press.

KORF, R.P., 1982 - Mycological and lichenological implications of changes in the code of nomenclature enacted in 1981. Mycotaxon, 14(2): 476-490.

MATSUSHIMA, T., 1975 - Icones microfungorum a Matsushima lectorum. Kobe, 209 p. 415 pl.

MATSUSHIMA, T., 1980 - Saprophytic microfungi from Taiwan. Part 1. Hyphomycetes. Matsushima mycological memoirs, 1, 82 p.

OUDEMANS, C.A.J., 1903 - Contributions à la flore mycologique des Pays-Bas. XIX. Nederl. Kruidk. Arch., ser. 3, 2(4): 851-928. tab. 6-9.

PETCH, T., 1944 - Notes on Entomogenous fungi. Trans. Br. myc. Soc., 27(1): 81-93.

SACCARDO, P.A., 1877 - Fungi italici autographice delineati. Fasc. I-IV, Padova. Michelia commentarium mycologicae italicae, I(1): 73-100.

SUTTON, B.C., 1975 - Hyphomycetes on cupules of Castanea sativa. Trans Br. mycol. Soc., 64(3): 405-426.

VON HOEHNEL, F., 1909 - Fragmente zur Mykologie. Sitzungsber. Kaiserl. Akad. Wiss. Wien, Math. nat. Kl., 118(1): 275-452.

VOS, E.G. & W. GREUTER, 1981 - Synopsis of Proposals to amend the International Code of Botanical Nomenclature submitted to the Thirteenth International Botanical Congress, Sydney, 1981. Taxon, 30(1): 95-293.

MYCOTAXON

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NEW SPECIES, NEW VARIETIES, AND A NEW RECORD OF *PSILOCYBE* FROM BRAZIL

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SUMMARY

Two new species of *Psilocybe*: *P. trufemi* Guzmán & Bononi and *P. microcystidiata* Guzmán & Bononi, and two new varieties: *P. zapotecorum* var. *ramulosum* Guzmán & Bononi and *P. banderillensis* var. *paulensis* Guzmán & Bononi are described, as well as one new record of *P. acutipilea* (Speg.) Guzmán from the State of Sao Paulo is discussed. All these fungi (except *P. trufemi*) are hallucinogenic and belong to the Section *Zapotecorum* (*P. microcystidiata* and *P. zapotecorum* var. *ramulosum*), Section *Mexicanae* (*P. acutipilea*), and Section *Brunneocystidiatae* (*P. banderillensis* var. *paulensis*). But *P. trufemi* belongs to Section *Singerinae* and is not hallucinogenic. Moreover, the topotypes of both *P. brasiliensis* Guzmán and *P. furtadoana* Guzmán were also collected.

INTRODUCTION

Since the studies on South American species of *Psilocybe* first made by Singer & Smith (1958) and Singer (1969), and then by Guzmán (1978), no more information has been available on these fungi. Guzmán (op. cit.) considered 66 species of *Psilocybe* from Central and South America (except Mexico), of which he described 15 new species. He considered only 8 species from Brazil.

* Supporting by CONACyT at Mexico.

In the present contribution 5 new records of *Psilocybe* from Brazil are discussed, of which 4 are new taxa. In addition to this, the topotypes of both *P. brasiliensis* Guzmán and *P. furtadoana* Guzmán were collected in Campos do Jordao, State of Sao Paulo. This paper is part of the results of a stay in Brazil of one of the authors (Guzmán), first in November 1982 and then in May 1983, teaching mycology and collecting mushrooms, mainly Agarics in a Goverment Program to study the mycoflora of Agaricales in the State of Sao Paulo.

The authors express their acknowledgment to the Secretaria da Agricultura e Abasteamento of Sao Paulo for the grant to Guzmán to study fungi in Brazil. They also thank to Sandra Farto Botelho Trufem of the Institute of Botany of Sao Paulo, for her valuable help both in the field and in the laboratory. Special thanks are due to Sandra M. Gomes da Costa for collecting the type of *P. trufemi*, as well as her valuable help in this work. Marina Capelari, Benjamin Moya Rodriguez, Pedro Küpper, N.K.S. Yokomizo, and L.A. Zavala-Camin helped collected some of the important specimens here discussed. This paper was critized by Dr. A.L. Welden of Tulane University and Laura Snook of INIREB. One of the authors (Guzmán) thanks Biologist Santiago Chacón and Mr. Luis González for their help in the laboratory of INIREB; he also is grateful to CONACyT for funding support to his researches on fungi.

NEW SPECIES OF *PSILOCYBE*

Psilocybe trufemi Guzmán & Bononi, sp. nov.
Figs. 1 - 5

Pileus 5-15 mm latus, convexus vel applanatus, glaber, siccus, subhygrophanus, brunneus vel alutaceus. Lamellae subadnatae, ochraceo-violaceae. Stipes 20-30 x 1-2 mm, brunneus vel rufo-brunneus, fibrillosus. Sine annulo. Caro pilei et stipes brunneola, haud caerulescens. Sporis (7-) 8-9 (-10) x (5-) 5.5 - 6.7 (-7) x 5-6 µm, subrhomboideis vel subellipsoideis crassis tunicatis. Pleurocystidiis idem ac cheilocystidiis, 40-60 x 11-17 µm, copiosis, hyalinis, sublageniformis vel mucronatis, crassis tunicatis. Ad terram, in silvis Araucariae Podocarpique , Prope Campos do Jordao, Parque Florestal, Sao Paulo, Brazil, Col. Gomes da Costa, November 29, 1982 (SP-177872 Typus).

Pileus 5-15 mm diam., convex to almost plane, smooth or slightly striate at the margin, glabrous, dry, brownish to straw color or alutaceus, subhygrophanous. Lamellae subadnate, brownish violaceous with somewhat whitish edges. Stipe 20-30 x 1-2 mm, uniform, brownish to reddish brown, fibrillose. Context thin, yellowish to brownish, unchanging when cut. Odor and taste slightly fungoid or not differentiated.

Spores (7-) 8-9 (-10) x (5-) 5.5 - 6.5 (-7) x 5-6 µm, subrhomboid in frontal view, or subellipsoid in lateral view, brownish yellow, thick walled and with a broad basal germ pore. Basidia 15-25 x 6-7 µm, 4- spored, subcylindric or subpyriform, hyaline. Pleurocystidia 40-60 x 11-17 µm, very abundant, hyaline, thick walled mainly at the apex or in the middle, walls 0.5-1.5 µm, sometimes up to 4 µm thick, sublageniform with a short neck, sometimes moniliform, or mucronate (rare), and short pedicellated. Cheilocystidia as the pleurocystidia in size and form, but more frequently lageniform with neck moniliform. Subhymenium and hypodermium with globose elements, strongly and irregularly incrusted on the walls with orangish brown pigment. Trama regular, with brownish and incrusted to hyaline hyphae, up to 20 µm diam. Epicustis formed by elogated, thin irregularly pigmented hyphae. Clamp connections rare.

Habitat. Gregarious on grassy soil in a forest of *Araucaria* and *Podacarpus*, at 1600 m altitude (type localities of both *P. brasiliensis* Guzmán and *P. furtadoana* Guzmán, as well as the habitat of *P. caeruleoannulata* Singer ex Guzmán, all of them also collected). Known only from the type locality. Fruiting in November.

Material studied. BRAZIL, Sao Paulo State, Campos do Jordao, Parque Florestal, November 29, 1982, Col. S.M. Gomes da Costa s.n. (Type, SP-177872) (Isotype XAL); N.K.S. Yokomizo s.n. (SP-177869); G. Guzmán s.n. (SP-177870)(all collected from the same date).

Discussion. *P. trufemi* is close to *P. venezuelana* Dennis, a species known only from Venezuela (El Avila) (Dennis, 1961; 1970). It differs mainly in the size of the spores, which are smaller in the latter species [(5-) 6-7 (-7.5) x (3.5-) 4-4.5 µm]. Both species belong to the Section *Singerinae* Guzmán and as are all the members of that Section (Guzmán, 1983) they are not hallucinogenic. The name of the species is in honor to the Biologist Sandra F.B. Trufem for her valuable work in mycology.

Psilocybe microcystidiata Guzmán & Bononi, sp. nov.
Figs. 6 - 7

Pileus 7-10 mm latus, conicus vel campanulatus, rufo brunneus, hygrophanus, subviscidus. Lamellae subadnatae, fusco-brunneae. Stipes 25-30 x 1-2 mm, dilute brunneus vel rufo-brunneus. Sine annulo. Caro caerulescens. Sporis (5.5-) 6-7 x 3-3.5 (-4) µm, subellipsoideis. Pleurocystidiis 10-21 (-24) 7-10 (-12) µm, hyalinis, copiosis, ventricosis vel subnapiformis vel subglobosis. Cheilocystidiis 8-13 x 1.5-3 µm, hyalinis, sublageniformibis. Ad terram, Prope Pouso Alegre, Minas Gerais, Brasil, Col. P. Küpper, December 1982 (SP-178161 Typus).

Pileus 7-10 mm diam., conic to campanulate, subviscid, glabrous and smooth to slightly striate at the margin, reddish brown or darker, hygrophanous. Lamellae subadnate , violaceous brown, with whitish floccose edges. Stipe 25-30 x 1-2 mm, uniform to somewhat bulbous at the base, brownish to reddish brown, covered by small whitish floccose scales. Annulus absent. Context thin, brownish, bluing.

Spores (5.5-) 6-7 x 3-3.5 (-4) µm, ellipsoid or subellipsoid, both in frontal and lateral view, thin walled, brownish, with a broad germ pore. Basidia 10-15 x 4-5 µm, 4- spored, hyaline, subcylindric or ventricose. Pleurocystidia 10-21 (-24) x 7-10 (-12) µm, abundant, hyaline to somewhat yellowish brown, fusiform, ventricose, globose or napiform. Cheilocystidia 8-13 x 1.5-3 µm, necks 0.5-1 µm thick, hyaline, regular or irregularly sublageniform. Subhymenium with elongated elements strongly pigmented on the walls with irregularly incrusted brown pigment, hyphae up to 15 µm diam. Hypodermium as in the subhymenium. Trama regular, incrusted to hyaline. Pileus surface with elongated parallel hyphae, somewhat incrusted as those of the subhymenium. Clamp connections observed.

Habitat. Gregarious on soil, only know from the type locality.

Studied material. BRAZIL, Minas Gerais State, Pouso Alegre, Col. Pedro Küpper, December 1982 (SP-178161 Type).

Discussion. This species belongs to the Section *Zapotecorum* because of the structure of the spores and the bluing feature of the fruit body (Guzmán, 1983). It differs from all the species of the Section in its small cheilocystidia, smaller even than those recently described in the same Section (Guzmán, 1982; Cifuentes & Guzmán, 1981) from Mexico.

Psilocybe zapotecorum Heim emend. Guzmán
var. *ramulosum* Guzmán & Bononi, var. nov.

Figs. 10 - 13

Cheilocystidiis ramosis vel inusitatis, 8-20 (-35) x 3-6 µm a typo species differt. Ad terram, in silvis subtropicalis. Insula Cardoso, Prope Cananéia, Sao Paulo, Brasil, Col. Guzmán 22955, November 18, 1982 (SP-177674 typus).

Pileus 20-80 mm diam., conic to subcampanulate, papillate, smooth to slightly striate at the margin, glabrous, lubricous, brown chocolate with some violaceous brown tones to straw color, hygrophanous. Lamellae subadnate, violaceous brown, with whitish or concolorous margins. Stipe 40-140 x 5-10 mm, uniform or somewhat thicker at the base, cartilagineus in the stipe, bluing very slowly. Taste and odor slightly farinaceous or fungoid. KOH stains all the parts reddish brown to blackish. Spore print dark violet brown.

Spores 5.8-6.5 (-7.5) x 3.8-4.2 µm, subellipsoid or ellipsoid both in frontal and lateral view, thin walled, brownish pale with a broad germ pore. Basidia 15-22 x 5-6 µm, 4- spored or 2- spored, hyaline, ventricose. Pleurocystidia 15-35 (-45) x 10-13 (-15) µm, neks 2-4 µm thick, very abundant, hyaline or with some brown chocolate diffuse pigment, variable in form, from globose, ventricose, subfusiform, submucronate to langeniform with short or large uniform or moniliform neck. Some pleurocystidia are prolongations of the hyphae of the subhymenium (pseudocystidia, Fig. 12-b). Cheilocystidia 8-20 (-35) x 3-6 µm, hyaline,abundant, forming a sterile band at the edge of the gill, sublageniform with a short to long neck (1-1.5 µm thick), frequently profusely branched, sometimes irregularly so. Subhymenium subparenchymatous, strongly incrusted on the walls with brownish yellow pigment, elements up to 20μdiam. Laticifer hyphae present,hyaline to yellowish 3-6 µm diam. Trama regular with incrusted pigmented to hyaline hyphae 8-25 µm thick. Hypodermium subparenchymatous, as that of the subhymenium. Pileus surface with prostrate hyphae, irregularly incrusted with brown pigment. Clamp connections commom throughout. Some parts of the subhymenium with bluing diffuse pigment in KOH, mounted tissue.

Habitat. Gregarious on bare clay soil, in a trail in a subtropical (or mesophytic) forest. Fruiting in November.

Material studied. BRAZIL, Sao Paulo State, Mpio. de Cananéia, Ilha do Cardoso, Col. Guzmán 22955, November 18, 1982 (SP-177674 Type) (XAL Isotype).

Discussion. This variety differs from the type in its branched cheilocystidia (in the type are unbranched and normally sublageniform). The brown pleurocystidia and the pseudocystidia, together with the branched cheilocystidia, and its more southern locality suggest a new species, but we prefer to consider this fungus as a variety of *P. zapotecorum* until more collections can be made, as well as studies in the variability of the species. The habitat of both varieties is the same. This fungus very problably is hallucinogenic, as is the type variety, which is one of the most important hallucinogenic mushrooms of the Mexican Indians from the State of Oaxaca (Zapotec Indians).

Psilocybe banderillensis Guzmán
var. *paulensis* Guzmán & Bononi, var. nov.

Figs. 14 - 17

A var. typo differt pleurocystidiis copiosis sublageniformis vel ventricosis et cheilocystidiis faciebus inaequalis. Ad terram, in silvis subtropicalis. Insula Cardoso, Prope Cananéia, Sao Paulo, Brasil, Col. Guzmán 22960 (SP-177707 Typus).

Pileus 5-12 mm diam., conic campanulate, subumbonate, glabrous, smooth to slightly striate at the margin when humid, subvisid to lubricous, hygrophanus, chocolate brown or reddish brown to darker,in dry blackish. Lamellae adnate, pale dark violaceous with somewhat whitish edges. Stipe 20-50 x 1-1.5 mm, uniform, subsinuous , reddish brown, covered by whitish small floccose scales, hollow, cartilagineus. Veil farinaceous, staining slightly blue. All parts blackish brown in KOH.

Spores (5-) 5.5-6.5 (-7) x 5-6 x 4-5 µm, rhomboid in face view but subellipsoid in side view, brownish, thick walled with a broad germ pore. Some spores are irregular in form. Basidia 15-20 x 5-8 µm, 4- spored, subventricose or subpyriform. Pleurocystidia 15-32 x 7-12 µm, abundant, hyaline to more commonly brown or reddish brown, sublageniform with short and thick neck or ventricose. Cheilocystidia 10-25 x 3-5 µm, hyaline, sublageniform, frequenlty irregularly branched, some are very irregular in form. Subhymenium subparenchymatous, with incrusted yellowish brown pigment. Trama regular, hyaline to pigmented with incrusted pigment on the walls. Surface of the pileus formed by elongated subgelatinized hyaline, brownish to hyaline hyphae, 2-4 µm thick. Hypodermium with elongated to subcelluar elements, strongly incrusted, 3-6 µm diam. Clamp connections rare.

Habitat. Gregarious on bare soil in a trail of the a subtropical (or mesophytic) forest. Fruiting in November.

Material studied. BRAZIL, Sao Paulo State, Mpio. de Cananéia, Ilha do Cardoso, Col. Guzmán 22960, November 18, 1982 (SP-177707 type) (XAL-Isotype).

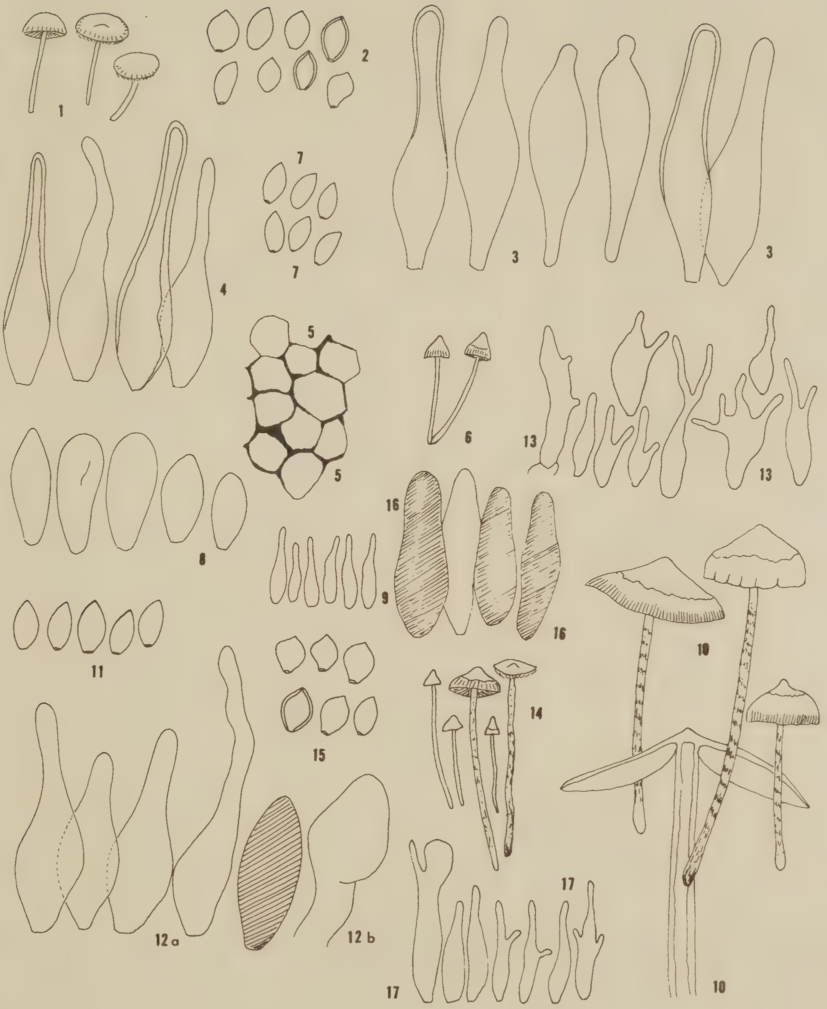
Discussion. The form of the pleurocystidia, as well as the abundance, and the irregular form of the cheilocystidia, as well as the southern locality, are the features that separates this variety from the type, which is know only from the State of Veracruz, Mexico (Guzmán, 1978; 1983). These fungi belong to the Section *Brunneocystidiatae* Guzmán, distinguished by their brown pleurocystidia. All of them seem to be hallucinogenic mushrooms.

A NEW RECORDS OF *PSILOCYBE ACUTIPILEA*

Psilocybe acutipilea (Speg.) Guzmán, was described by Spegazzini as *Deconica acutipilea* in 1889 from Apiai (=Apiahy), in Brazil. Guzmán (1978) transferred Spegazzini's fungus to *Psilocybe*, based in the study of the type (LPS-38307). Now the authors have the oportunity to study another collection (the Second collection in the species!), collected by L.A. Zavala-Camin, in Itatiaia, in the Sao Paulo to Minas Gerais road, State of Sao Paulo, in January 1983 (the type was collecteds in autumn 1881).

The only specimen collected (deposited in SP) agrees well in all their macroscopic and microscopic features with the type, according to Guzmán's study (1978). The basidia (not reported at that time) are hyaline, 4- spored or 2- spored, ventricose or subpyriform, 15-22 x 8-10 µm. The spores are (7.5-) 8.5-10 (-11) x 5-7 x 4-5 µm. This species is very similar to *P. mexicana* Heim and may be merely a subvariety. "The only difference seems to be the narrow spores and the long necks of the cheilocystidia", wrote Guzmán (1983). *P. mexicana* is know only from Mexico (several subtropical localities), and Guatemala, and is one of the most important of the hallucinogenic fungi.

Figs. 1-17.- 1-5: *Psilocybe trufemi* (type), 1: three fruit bodies, 2: spores, 3: pleurocystidia, 4: cheilocystidia, 5: elements of the hypodermium.- 6-9: *Psilocybe microcystidiata* (type), 6: two carpophores, 7: spores; 8: pleurocystidia, 9: cheilocystidia.- 10-13: *Psilocybe zapotecorum* var. *ramulosum* (type), 10: four fruit bodies, 11: spores, 12: pleurocystidia, 13: cheilocystidia. 14-17: *Psilocybe banderillensis* var. *paulensis* (type), 14: Five carpophores, 15: spores, 16: pleurocystidia, 17: cheilocystidia.


12 a
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LITERATURE CITED

CIFUENTES, J. and G. GUZMAN, 1981. Descripción y distribución de hongos tropicales (Agaricales) no conocidos previamente en México. *Bol. Soc. Mex. Mic. 16*: 35-61.

DENNIS, R. W. G., 1961. Fungi venezuelani, IV. *Kew Bull. 15*: 67-156.

________________, 1970. *Fungus flora of Venezuela and adjacent countries.* Kew Bull. Add. Ser. III, Cramer, Lehre.

GUZMAN, G., 1978. The species of *Psilocybe* known from Central and South America. *Mycotaxon 7*: 225-255.

________________, 1982. Nuevos datos sobre el género *Psilocybe* y descripción de una nueva especie en México. *Bol. Soc. Mex. Mic. 17*: 89-94.

________________, 1983. *The genus Psilocybe.* Beih. Nova Hedwigia 74, Cramer, Vaduz.

SINGER, R. 1969. *Mycoflora Australis.* Beih. Nova Hedwigia 29, Cramer, Lehre.

SINGER, R. and A.H. SMITH, 1958. Mycological investigations on Teonanácatl, the Mexican halluconogenic mushroom, II. *Mycología 50*: 262-303.

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NEW RECORDS OF FALSE TRUFFLES IN PINE FORESTS OF ARIZONA

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SUMMARY

Eighteen species of hypogeous basidiomycetes are reported as occurring in pure and mixed stands of *Pinus ponderosa* Laws. in Arizona. The genera represented are *Brauniellula, Gautieria, Hymenogaster, Hysterangium, Leucogaster, Martellia, Melanogaster, Rhizopogon, Sclerogaster* and *Sedecula*. Species descriptions are provided where species determinations were uncertain or where additional characteristics could be added to existing descriptions. Notes on relative abundance, growth habit and distribution are also presented along with illustrations of spores diagnostic for generic determinations.

Increased interest in hypogeous fungi, particularly as mycorrhizal associates of coniferous trees, has led to studies of their distribution in the western United States (e.g., Smith and Zeller, 1966; Harrison and Smith, 1968; Fogel and Trappe, 1976; Smith et al., 1981) and in northern Mexico (Trappe and Guzman, 1971; Hosford and Trappe, 1980). The Arizona hypogeous mycoflora has not been previously investigated despite the presence of an extensive, nearly pure, ponderosa pine forst (*Pinus ponderosa* Laws.) of some 7.5 million acres. Since commencing such an investigation in 1979, I have found the hypogeous mycoflora to be quite diverse and seasonally abundant. There is evidence of widespread mycophagy by squirrels and other rodents; this combined with the adaptive advantage of the hypogeous habit appear to be important contributing factors to their prevalence in the arid coniferous forests of the southwest United States.

In an earlier study (States, 1983), species of hypogeous ascomycetes associated with ponderosa pine were reported. In this continuation of the study, the commonly occurring hypogeous basidiomycetes, false truffles, are listed along with notations as to their general abundance and distribution. The record includes species which also occur in stands of ponderosa pine mixed with other conifers. The list is not exhaustive and many collections await further taxonomic study, particularly in the genus *Rhizopogon*.

The specimens were compared with type material or submitted to authorities for annotation whenever possible. Where species determinations were uncertain, a descriptive account of the essential taxonomic characteristics is provided. The classification of hypogeous fungi presents a considerable challenge to the mycologist. Fresh characteristics of the basidiocarps, especially pigmentation and color reactions of the peridium and gleba, are of primary importance in the use of extant keys. These characteristics are variable, especially given the often lengthy periods of basidiocarp development and with attendant environmental conditions. Collections obtained over a wide geographical range demonstrated considerable morphological variation. In areas of question, the species determinations are purposely conservative and await further critical taxonomic study. Few previous publications describing a hypogeous mycoflora have provided illustrations of the basidiospores. Spore characteristics are for the most part, definitive at the generic level. Illustrations are provided where spore characteristics are deemed useful.

Formulae and procedures for obtaining color reactions in KOH, iron salts and Melzer's iodine reagent were those outlined in Smith et al., 1981. Capitalized color names are from Ridgway (1912) color standards and descriptive accounts of color are based on both fresh and dried specimens for compatibility with the standard references. The collections cited are deposited in the mycological collection of the Deaver Herbarium, Northern Arizona University (ASC). Representative collections of *Rhizopogon* are deposited in Central Washington University (CWC), and collections of *Gautieria* and *Hymenogaster* are in the herbaria of the University of Minnesota (MPPD) and the University of Michigan (MICH), respectively.

1. *BRAUNIELLULA NANCYAE* Smith & Singer, Mycologia 50:927-938. 1958.

As a hypogeous member of the Gomphidiaceae, this species superficially resembles an immature *Chroogomphus vinicolor* with which it shares general coloration and habitat. The margin of the pileus does not fully separate from the stipe-columella and the lamellae remain compactly folded beneath the peridium. The visible prominence of the leptocystidia is a striking feature of the species. They measure 130-140 x 30-36 µm and are encrusted with vinaceous debris. The large spores, 16-30 x 6.5-9 µm, are illustrated in Fig. 1.

Gasterocarps scattered and locally abundant during wet periods beneath the needle litter (duff) of ponderosa pine or imbedded in loose, mineral soil below the duff layer; found August through October.

COLLECTIONS EXAMINED: Coconino County--Woody Mtn. near Flagstaff, *States* AHF126; Mt. Elden near Pipeline Rd., Flagstaff, *States* AHF263; Transition Zone Horticultural Institute, near Flagstaff, *States* AHF284; Paradise Rd., Flagstaff, *States* AHF274.

2. *GAUTIERIA CRISPA* Stewart & Trappe nom. ined.

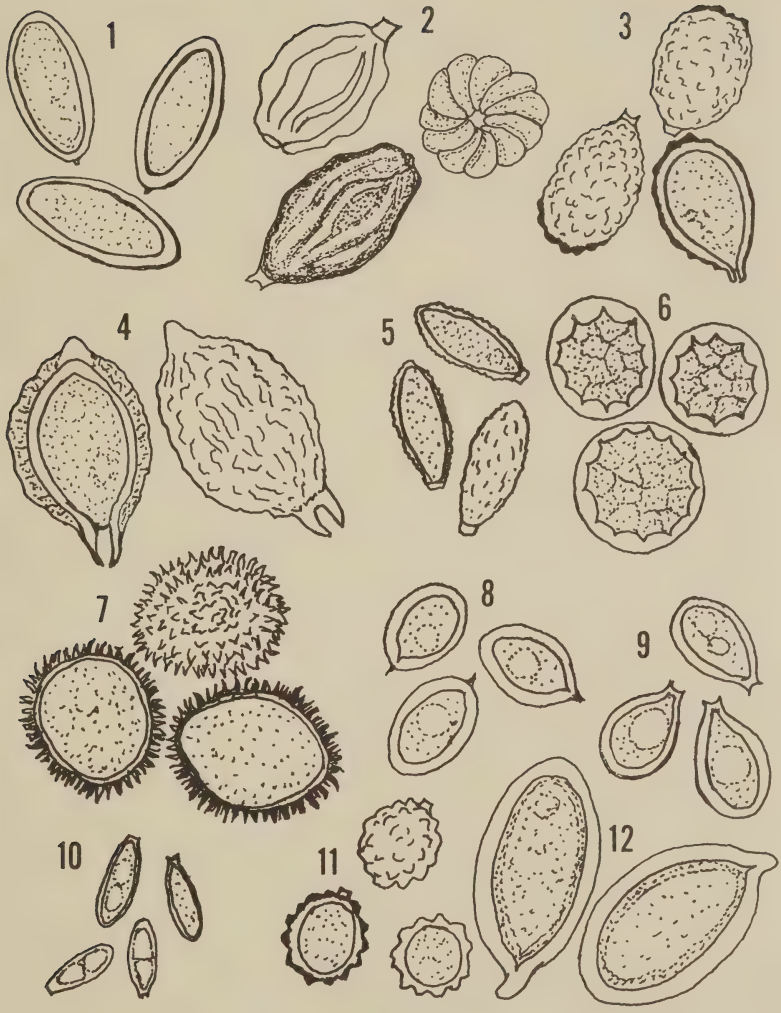
Gastrocarps produced singly or gregarious, sometimes caespitose or fused at the bases to form large cauliflower like clusters, each with a large primary basal rhizomorph or less often several rhizomorphs, subsphaerical to irregularly lobed with a tendency to be basally radicate and apically flattened or depressed; thinly covered with a white, silky weft of peridial hyphae but this is early evanescent or lacking leaving the gleba entirely exposed; gleba tough, cartilagenous, crisp on cutting, dull white in color, then Cartridge Buff to Yellow Ochre as the spores mature, finally cinnamon at maturity, bruising Light Greenish Yellow to Amber Yellow especially in areas of insect damage, Buckthorn Brown when wet and gelatinizing, Glaucous Blue Green in $FeSO_4$ with tramal veins becoming Purplish Gray to Olivaceous Black after soaking for several minutes; glebal chambers elongate and irregular, 1-2 per mm; columella developed to varying degrees but mostly basal and percurrent with white to clear gelified septa, septa remaining firm and cartilagenous, composed of hyphae that are swollen 9-11 µm at the septa; basidia clavate, 20-45 x 9-15 µm 4-spored with prominent claw-like sterigmata measuring 3-6 µm long; cystidia absent; spores broadly obovoid, guttulate, light yellow to Ochraceous Tawny in mass, dextrinoid in Melzer's reagent, ornamented with 9-11 even or warted longitudinal ridges which terminate at the apex (Fig. 2), 11-17 (19) x 7.5-10 (11) µm; odor pronounced at maturity, sweet-musky that is almost nauseating when fruitbodies are in a confined atmosphere.

The characteristics of this species closely follow those reported by Stewart (1974) in his doctoral dissertation. I have encountered it throughout the western United States where it is associated with lodgepole pine (*Pinus contorta* Dougl.). Gasterocarps are produced in great abundance throughout the growing season but appear most frequently in early spring, sometimes in quantities of up to 15 kilograms per hectare. Although typically found associated with ponderosa pine, the species has been recovered from beneath Gambel oak (*Quercus gambelii* Nutt.) and pinyon pine (*Pinus edulis* Engelm.). The basidiocarps are frequently found entwined by the roots of the host associate and are produced at various levels in the mineral soil.

COLLECTIONS EXAMINED: Coconino County--Kendrick Park, *States* AHF1, AHF55, AHF327; North Kaibab Plateau at Jacob Lake, *States* AHF30, AHF70, AHF96, AHF112, AHF208; Happy Jack Ranger Sta., *States* AHF134; Transition Zone Horticultural Institute near Flagstaff, *States* AHF98, AHF323, Gila County--Zane Grey's Cabin, *States* AHF223.

3. *GAUTIERIA GAUTIERIODES* (Lloyd) Zeller & Dodge, *in* Dodge and Zeller, Ann. Missouri Bot. Gard. 21:697. 1934.

Gasterocarps 0.5-3.0 cm diameter, irregularly lobed with brown basal rhizomorphs, white peridium which gradually breaks down to expose the glebal chambers at maturity; columella basal with percurrent white veins ramifying the gleba; gleba firm but fragile and crumbly when dry, with labyrinthiform chambers 1-2 mm broad, buff colored to Cinnamon Brown, the Cinnamon Brown spore mass contrasting with the Light Buff tramal tissue; basidia 4-spored, 25-40 x 8-10 µm, interspersed with cystidial elements similar in dimensions but with subcylindric rather than clavate apices; spores ellipsoid, the apex rounded with short sterigmata, the base pedicillate, (15) 16-22 x 9-12 (13) µm, with pronounced longitudinal ridges not fully continuous to the base and somewhat warted in



Figs. 1-12. Spores of representative species in genera of hypogeous Basidiomycetes. (All figures approximately X1500.) (1) *Brauniellula nancyae* (2) *Gautieria crispa* (3) *Hymenogaster brunnescens* (4) *H. subalpinus* (5) *Hysterangium separabile* (6) *Leucogaster rubescens* (7) *Martellia ellipsospora* (8) *Melanogaster euryspermus* (9) *M. tuberiformis* (10) *Rhizopogon evadens* (11) *Sclerogaster xerophilum* (12) *Sedecula pulvinata*

the midsection; odor mild when young becoming slightly garlic-like and offensive in age.

Solitary to clustered in deep litter or shallow mineral soil, the gasterocarps appear June through September in association with mixed stands of ponderosa pine, douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco), white fir (*Abies concolor* (Gord. et Glend.) Lindl. ex Hildebr.), and Gambel oak (*Quercus gambelii*).

COLLECTIONS EXAMINED: Coconino County--North Kaibab Plateau at Murray Lake, *States* AHF76, AHF207; Paradise Rd., Flagstaff, *States* AHF156, AHF169, AHF270; Marshall Lake, *States* AHF184; Pima County--Mt. Lemmon at Bear Wallow, *Gilbertson* AHF241, *States* AHF245.

4. *HYMENOGASTER BRUNNESCENS* Smith, Mycologia 58:111. 1966.

Gasterocarps single to gregarious, 1-4 cm broad but as large as 8 x 10 cm, subglobose, often irregularly lobed with fusions to adjacent fruitbodies, sparsely covered with appressed rhizomorphs or merely basally attached; peridium 0.1-0.8 mm thick, white but quickly bruising or oxidizing first bright Yellow-Ochre and then drab brown to dark Bister, wet and almost viscid when handled, remaining white to buff in folds or depressions, drying dark blackish brown, soil and debris often remaining attached to the dried surface; epicutis finely fibrillose with swollen hyphae up to 15 µm diameter and bearing clamp connections; gleba firm when cut and exuding clear fluid, rich rust cinnamon with empty labyrinthiform chambers measuring 0.3-0.8 mm broad; columella white to light ochraceous, basal with septa raditing as whitish streaks upwards into the gleba; basidia 4-8 spored and subtended by swollen brachybasidioles; spores ellipsoid-obovate, warty rugulose especially at the apex, lacking an apical beak, pedicel short and truncate (Fig. 3), rich cinnamon brown in KOH, yellowish bronw in H_2O mounts, 10-13.5 x 7-9 µm; odor quite distinctive for the species, strongly aromatic and penetrating.

Within *Hymenogaster*, Smith (1966) established the subgenus *Dendrogaster* to which this species clearly belongs. However, it is difficult to separate it from *H. subochraceus* and *H. subolivaceus*. Although the average spore sizes are greater, characteristics of *H. brunnescens* have been found to span those of the other two species. I have examined collections from the western U.S. including some from the type locality of *H. subolivaceus*. Clearly, further work is needed to clarify the taxonomic placement of these species.

With few exceptions, gasterocarps are produced in deep pine litter or shallow mineral soil when moisture is abundant; fruiting occurs throughout the season but it is abundant and widespread April through early June in pure ponderosa pine stands.

COLLECTIONS EXAMINED: Coconino County--Mogollon Rim and Arizona Hwy 87, *States* AHF195; Paradise Rd., Flagstaff, *States* AHF212, AHF217, AHF299; Mormon Lake, *States* AHF215.

5. *HYMENOGASTER SUBALPINUS* Smith, Mycologia 58:120-121. 1966.

Gasterocarps 0.5-2.0 cm broad, subglobose or variously compressed by the surrounding soil, with inconspicuous basal rhizomorphs, single or in clusters, initially Buff colored with Yellow Ochre patches in exposed or bruised portions, Buffy Brown in age; peridium thin, 0.1-0.6 mm, the epicutis composed of hyphae that are often inflated, the subcutis mostly pseudoparenchymatous, slightly olivaceous in $FeSO_4$; gleba firm, Cartridge Buff in youth becoming Avellaneous and finally Benzo Brown as the spores mature; chambers small, round or sinuous; columella basal and rudimentary; trama narrow, composed of inflated hyphae which become pseudoparenchymatous in the sybhymenium; basidia 2-4 spored (mostly 2), with stout sterigmata which are sometimes pigmented as are the spores; no cystidia but with occasional sterile elements with acute apices similar in appearance to a single sterigmatal extension; spores ellipsoid to ovate, with a prominent apical beak and pedicel, the surfacing coarsely warted and slightly striate (Fig. 4), rich rusty brown, 16-28 (30) x 9-14 µm; clamp connections absent but the septa unusually sinuous; odor strongly of mushrooms and pungent in age.

This species is closely related to *H. parksii* Zeller & Dodge but generally has larger spores and lacks much of the pseudoparenchymatous tissue. I have not found it to possess the fusoid leptocystidia which Smith (1966) uses as a distinguishing feature in his key. It is appropriate that mention of the cystidia was omitted from the original species diagnosis for they are likely to be sterile basidial elements instead.

Found singly or in clusters at various depths in mineral soil, usually below deep litter as well, produced most abundantly May through July and not generally in large quantities, associated with ponderosa pine and in pine stands mixed with Douglas fir and Gambel oak.

COLLECTIONS EXAMINED: Coconino County--Mormon Lake, *States* AHF68, AHF218; North Kaibab Plateau, *States* AHF72; Mt. Elden near Flagstaff, *States* AHF163, AHF322.

6. *HYSTERANGIUM SEPARABILE* Zeller, Mycologia 33:203-204. 1941.

Gasterocarps 0.5-3.0 cm broad, subglobose, surface smooth and often dimpled, white to pale ochraceous buff, readily bruising pink although some do not, color changing to drab brown, associated with a dense mycelial spawn which ramifies through the mineral soil, with a network of white rhizomorphs basally attached or closely appressed at various points to the peridial surface; peridium 0.2-1.0 mm thick (largest in large, young specimens), the outer layer filamentous 5-25 µm thick above a pseudoparenchymatous layer of cells that measure 25-45 µm in diameter, the subcutis a thin trichodermium overlying the gleba, the entire peridium easily separable from the gleba and often splitting in sections on drying; gleba firm and rubbery but gradually gelatinizing, Pale Bluish Green, darkening to Artemesia Green and finally greenish black, (some collections with more olive tones), marbled by clear gelatinous tramal veins radiating from a percurrent columella; cavities small, stuffed with spores; spores lanceolate with a roughened epispore, basally truncate (Fig. 5), olivaceous in mass, 12-20 x 5.5-8.0 µm; odor fetid at maturity.

Gasterocarps scattered or in clusters, often produced in large quantities throughout the growing season; perhaps one of the most abundant of all hypogeous fungi in coniferous forests with a broad host range including ponderosa pine, Douglas fir, pinyon pine, Gambel oak, white fir and cypress in our area.

COLLECTIONS EXAMINED: Coconino County--San Francisco Peaks, *States* AHF11, AHF32, AHF48, AHF50, AHF189; Transition Zone Horticultural Institute, AHF100; North Kaibab Plateau at Jacob Lake, *States* AHF43, AHF78, AHF110, AHF210; Mogollon Rim FS Hwy-3, *States* AHF66, AHF196. Gila County--Mogollon Rim and Arizona Hwy 260, *States* AHF324.

Pima County--Mt. Lemmon at Bear Wallow, *States* AHF249, AHF251.

Two other species of *Hysterangium* have been collected, *H. crassum* (Tul.) Fisher from Douglas fir stands and an undescribed species from pinyon pine. They will be treated in a later paper.

7. *LEUCOGASTER RUBESCENS* Zeller & Dodge, Ann. Missouri Bot. Gard. 11:389. 1924.

Gasterocarps 0.5-3.0 cm broad, subglobose to irregularly lobed, surface smooth with scattered appressed rhizomorphs, white at first turning pinkish cinnamon with rosy buff areas, Luteous to Orange Rufous in age and drying salmon to Hessian Brown, colors intensified in KOH; gleba white then Pale Luteous, marbled with globose to polyhedral chambers, the chambers filled with a white latex-like fluid that contains spores and tastes like a mixture of flour and water, evacuated on drying; basidia 4-spored, spores hyaline, sphaerical to irregularly oblong (resembling hülle cells when young), echino-recticulate within a thick epispore wall (Fig. 6), 11-18 μm including the epispore, odor strong and distinctive.

Gasterocarps produced in shallow mineral soil beneath needle litter and grass rhizospheres, generally scattered and not abundant, associated with ponderosa pine in the spring and summer, June-July.

COLLECTIONS EXAMINED: Coconino County--Mt. Elden near Flagstaff, *States* AHF333, AHF282.

8. *MARTELLIA ELLIPSOSPORA* (Zeller) Singer & Smith, Mem. Torrey Bot. Club 21:30. 1960.

Gasterocarps elongate, 0.5-2.5 cm in greatest diameter, white to pale ochraceous buff, drying wood brown, with inconspicuous white rhizomorphs over the surface; peridium finely fibrillose, compact, slightly separable; gleba chalky white to light Ochraceous Buff, chambers small but visible; basidia 1-2 spored; cystidia and sphaerocysts absent; spores densely echinulate, some ornaments wart-like, echinulae up to 3 μm high, strongly amyloid particularly the ornaments, broadly elliptical (Fig. 7), 14-19 x 12-15 μm, odor faint and mushroom-like.

This is the first record of a *Martellia* in Arizona and is a likely mycorhizal associate of ponderosa pine. It occurs infrequently both spring and fall in mineral soil beneath pine duff, singly and widely scattered.

COLLECTIONS EXAMINED: Coconino County--Fry Lake Rd., near Oak Creek Canyon, *States* AHF206; Transition Zone Horticultural Institute, *States* AHF231; Paradise Rd., Flagstaff, *States* AHF309.

9. *MELANOGASTER AMBIGUUS* (Vitt.) Tulasne, Ann. Sci. Nat. Bot. II. 19:378. 1843.

Gasterocarps subglobose, irregularly lobed, dimpled, 1.5-3.0 cm broad, with dark brown basal rhizomorphs that lightly cover the peridial surface, warm Buff then Brown to Prout's Brown, bruising fuscous, slightly olivaceous in $FeSO_4$; peridium fibrillose, smooth, 0.5 mm thick composed of hyphae with swollen cells and clamp connections; gleba with distinct white to yellowish tramal veins, chambers up to 1.0 mm diameter, filled with spores in gelatinous material, black with maturation of the spores; spores dark rust brown, broadly elliptical with subacute tips, base truncate and cupped, guttulate and thick-walled, 10-15 x 7-9 (10) µm; odor strongly metallic and disagreeable.

Fruiting bodies were encountered only once in three years of collecting in the same spot; associated with a mixed stand of ponderosa pine and Douglas fir beneath a thick layer of duff in September.

COLLECTIONS EXAMINED: Coconino County--Fry Lake Rd. near Oak Canyon Canyon, *States* AHF160.

10. *MELANOGASTER EURYSPERMUS* (Dodge & Zeller) Zeller, Mycologia 31:8. 1939.

Gasterocarps subglobose, somewhat lobed, 1-3 cm broad with conspicuous basally appressed rhizomorphs, white then Luteous when young, becoming brown in age, brownish on bruising and in KOH; peridium 0.8-1.0 mm thick but thinner in age, slightly viscid when wet, uniformly composed of compact hyphae that are continuous with glebal tissue; gleba firm, yellowish-olive to fuscous black at maturity; tramal septa white to light luteous, 20-30 µm wide, staining Artemesia Green in Melzer's, composed of swollen filamentous hyphae 10-25 µm diameter; chambers large and labyrinthiform, gelatinizing and filled with spores; basidia slowly evanescent, broadly clavate, 18-35 µm broad at the apex with short narrow sterigmata, 4-spored or occasionally 2-spored; spores ellipsoid to citriform, acutely truncate at the base, bluntly apiculate, guttulate in KOH (Fig. 8), Sienna to dark bister, (9.5) 11-16 x (7.5) 8-12 µm; odor pronounced at maturity and disagreeable.

Collections of basidiocarps were made in July and September beneath ponderosa pine litter and in the mineral soil up to 10 cm deep.

COLLECTIONS EXAMINED: Coconino County--Paradise Rd., Flagstaff, *States* AHF202; Mt. Elden near Flagstaff, *States* AHF224.

11. *MELANOGASTER TUBERIFORMIS* Corda, Sturm, Deutschl. Fl. III. 11:1. 1831.

Gasterocarps subglobose, variously shaped according to position in soil and litter, 0.8-3.5 cm broad, sparsely covered by separable black rhizomorphs more densely clustered at the base; peridium smooth, composed of tightly compressed hyphae in two layers, the outer layer of uniform, brown pigmented hyphae that descend into a second lightly pigmented layer of mixed hyphal and pseudoparenchymatous cells, this tissue descending into the gleba below; gleba Dark Olive to Fuscous Black, firm and resilient at first, gelatinous in age with contrasting white to Luteous tramal septa surrounding irregularly-shaped chambers; chambers filled with spores in a gel, drying hard as compact sphaerules or as a membranous film drawn away from the cavities; basidia hyaline, slowly evanescent, terminally clavate, 2-4 spored, subtended by clamp connections; spores obovate to pyriform (Fig. 9), rich rust to dark vinaceous brown, smooth, 10-14 x 6-10 µm; odor musty and disagreeable.

Associated with ponderosa pine roots, this species fruits in spring and fall, sometimes in abundance, imbedded in mineral soil up to 6 cm but occasionally in humus beneath a deep litter layer.

COLLECTIONS EXAMINED: Coconino County--North Kaibab Plateau at Jacob Lake, *States* AHF2, AHF137, AHF211; Paradise Rd., Flagstaff, *States* AHF154, AHF308.

12. *RHIZOPOGON EVADENS* Smith, *in* Smith & Zeller, Mem. New York Bot. Gard. 14:151-153. 1966.

Gasterocarps subglobose, often irregularly lobed and wrinkled as compressed by the soil, with dimpled depressions, 0.5-4.5 cm broad, pure white to cartridge buff, pale luteous areas developing temporarily in some specimens, quickly pink to Coral Red on bruising or handling, then changing dingy brown to Umber Brown, unevenly Tawny Olive to Umber Brown on drying, the dried surface wrinkled and refractive in some, Russet Brown when revived in KOH or in some specimens developing subdued reddish brown hues, light olive in $FeSO_4$, sparsely covered with appressed rhizomorphs similar in color to the surface; peridium 1-1.5 mm thick in young specimens, thin when older, finely fibrillose and matted smooth, bruising pink when cut in cross section as does the sterile tissue which sometimes descends into the gleba, somewhat friable on drying and separable under pressure; gleba chalky white at first, Buffy Citrine Green becoming Yellowish Olive, gelatinizing Honey Yellow to Isabella Color, hard when dry but easily sectioned; chambers small and stuffed with spores; brachybasidioles present, slightly thick-walled; spores nonamyloid, 2-guttulate (appearing pseudoseptate), subfusoid to narrowly oblong (Fig. 10), hyaline but dingy yellow in mass, hilum indistinct, 6-8 (9.5) x 2.2-2.8 (3.0) µm; odor faintly to strongly metallic.

In some years, this species is the most abundant and widely distributed false-truffle in the ponderosa pine forest; fruiting throughout the growing season but most prevalent in spring and late fall; produced singly or in clusters and frequently following the tree root systems in rows or arcs; buried in mineral soil to various depths but found ocassionally on the surface beneath the litter layer.

As Smith and Zeller (1966) and Harrison and Smith (1968) have pointed out, *R. evadens* is closely related to several other species, particularly *R. separabilis, R. odoratus* Smith and *R. praestans* Harrison & Smith. Hosford (1975) has described a species, *R. smithii*, quite similar to *R. evadens* which also has a fleeting, yellow peridial coloration. It may be that with further study, this group of species may be found conspecific with *R. separabilis* described by Zeller (1939).

COLLECTIONS EXAMINED: Coconino County--North Kaibab Plateau at Jacob Lake, *States* AHF47, AHF97, AHF147; Kendrick Park, *States* AHF9, AHF26, AHF34, AHF56, AHF129, AHF130; Mogollon Rim on Arizona Hwy 87, *States* AHF65;

Transition Zone Horticultural Institute near Flagstaff, *States* AHF118, AHF262, AHF328; Oak Creek Canyon, *States* AHF120; Mormon Lake, *States* AHF132; Paradise Rd., Flagstaff, *States* AHF69, AHF125, AHF265, AHF321. Gila County--Zane Grey Cabin, *States* AHF219, AHF325.

13. *RHIZOPOGON OCHRACEORUBENS* Smith, *in* Smith & Zeller, Mem. New York Bot. Gard. 14:124-125. 1966.

Gasterocarps subglobose to oblong, generally robust, 1-6 cm broad, white and quickly passing through Pale Luteous stage, then tawny yellowish and finally Cinnamon Brown, densely covered by a network of Amber to Orange Rufous or in age Mars Brown rhizomorphs, free dark brown rhizomorphs at the base; peridium of appressed interwoven hyphae containing reddish brown to deep reddish brown pigment when dried or revived in KOH, staining Fuscous in age or in areas treated with KOH and $FeSO_4$, the surface not staining red when injured; gleba firm and crisp on sectioning, pallid the Olive Buff to Tawny Olive at maturity, not darkening on drying, chambers 2-4 per mm, drying hard but easily sectioned; spores oblong to ellipsoid, Cream Color in mass, hilum inconspicuous, biguttulate, 5.5-8.0 x 2.0-2.8 µm; odor faint and unpleasant.

Solitary to clustered under ponderosa pine, the gasterocarps are usually found under deep duff and shallowly imbedded in mineral soil; fruiting in midsummer to late fall. This species is closely related to *R. sublateritius* Smith and *R. occidentalis* Zeller & Dodge. Despite the report that *R. ochraceorubens* appears to occur only in association with lodgepole pine (Harrison and Smith 1968), its features in my collections and those reported in collections from Mexico (Hosford and Trappe 1980) clearly place it in the present taxon. Hosford (personal communication) reports it regularly from under ponderosa pine in the Cascades of the Pacific Northwest.

COLLECTIONS EXAMINED: Coconino County--Paradise Rd., Flagstaff, *States* AHF268, AHF277; Fry Canyon Rd., near Oak Creek Canyon, *States* AHF120; Transition Zone Horticultural Institute near Flagstaff, *States* AHF118, AHF161, AHF260, AHF328.

14. *RHIZOPOGON PINYONENSIS* Harrison & Smith, *in* Harrison and Smith, Canad. J. Bot. 46:890-893. 1968.

Gasterocarps generally large, 2-5 cm broad; white to pallid peridium overlaid with fawn colored appressed rhizomorphs, the tissues matted-fibrillose, drying dark brown to Fuscous, reacting instantly to KOH first Rose Pink then quickly changing to Vinaceous Brown and finally Fuscous Black, in $FeSO_4$ drab olivaceous then black; spores strongly amyloid and the olive gleba fuscous in Melzer's as a result, 7-10 x 3.0-4.5 µm; associated with pinyon pine (*Pinus edulis* Englm.). It commonly occurred in mixed pinyon and ponderosa pine stands, but it is more likely a pinyon pine associate. It is closely related to *R. fallax* Smith.

15. *RHIZOPOGON SUBCAERULESCENS* Smith, *in* Smith & Zeller, Mem. New York Bot. Gard. 14:44-48. 1966.

Gasterocarps generally small, 0.2-2.5 cm, globose, subglobose or variously shaped as compressed by the soil, white, grayish white to Cartridge Buff, compactly fibrillose and overlaid with white to Olive Ochre rhizomorphs, matted rhizomorphs at the base, free and conspicuously branched; peridium up to 1 mm thick; grayish white darkening to Buff Brown, the rhizomorphs darkening to Olivaceous Black; in KOH olive with a fleeting vinaceous hue in some but rapidly darkening olivaceous black, in $FeSO_4$ Benzo Green to Glaucous Blue Green then Greenish Slate-Black; gleba pale Vinaceous Buff, Isabella Color to Wood Brown at maturity, firm but gelatinizing with a granular texture and separating from the intact peridium, small chambered, 2-3 chambers per mm, variable blackish green reaction in Melzer's and $FeSO_4$; spores oblong, subfusoid, many irregular in outline, in amyloid or weakly amyloid, the amyloid reaction intensifying after drying, light yellow in mass, hilum prominent, 7-10 x 2.3-3.0 (3.5) µm; odor not distinctive.

This species is similar in distribution and abundance to *R. evadens* but is produced primarily in the fall beneath litter (infrequenlty in deep mineral soil) of ponderosa pine, Gambel oak, and alligator juniper (*Juniperus deppeana* Stead.). Many described species of *Rhizopogon* have similar characteristics, including *R. idahoensis* Smith, *R. tephrogleba* Harrison & Smith, and *R. subcaerulescens* var. *subpannosus* Smith. Smith (1966) cites it to be "the most difficult of all *Rhizopogon* species to identify."

COLLECTIONS EXAMINED: Coconino County--Paradise Rd., Flagstaff, *States* AHF139, AHF278, AHF294; North Kaibab Plateau at Jacob Lake, *States* AHF40, AHF46, AHF95, AHF109, AHF141; Kendrick Park, *States* AHF49, AHF128; Transition Zone Horticultural Institute near Flagstaff, *States* AHF119, AHF296, AHF300. Pima County--Mt. Lemmon at Bear Wallow, *States* AHF248.

16. *RHIZOPOGON SUBCROCEUS* Smith, *in* Smith & Zeller, Mem. New York Bot. Gard. 14:133-134. 1966.

Gasterocarps globose to subglobose, 1-3.5 cm broad, white to Salmon Buff, Apricot Buff when moist, no yellow phase, bruising Salmon Orange; surface dry and sparsely covered with darker rhizomorphs, drying Pinkish Cinnamon; peridium smooth and finely fibrillose, up to 1.0 mm thick, tissue over the gleba pseudoparenchymatous, in KOH Rose Pink to Maroon, in $FeSO_4$ greenish olivaceous to gray olivaceous; gleba white to light Yellowish Olive, in age Gray Olivaceous to Dark Olivaceous Brown, Black when gelatinized material is dry; spores narrowly oval to oblong, inamyloid, basal truncation inconspicuous, 6.6-8.5 x 2.5-3.0 µm; odor not distinctive.

Gasterocarps produced either singly or in clusters, locally abundant in the humus layer beneath the litter of pinyon pine. It is similar in appearance to *R. armeniacus* which is also associated with pinyon pine (Harrison and Smith 1968) but has much larger spores.

COLLECTIONS EXAMINED: Coconino County--Walnut Canyon, *States* AHF314, AHF319. Gila County--Mogollon Rim near Payson, *States* AHF220.

17. *SCLEROGASTER XEROPHILUM* Fogel, *in* Fogel, R., Mycologia 69:980-986. 1977.

Gasterocarps 0.5-2.5 cm broad, subglobose to elongate, sometimes fused together, enmeshed in a thick hyphal mat but occasionally free in well decomposed litter, white becoming Pale Luteous, covered by a weft of separable floccose mycelium; peridium duplex, thin, very strong and resists sectioning, tearing rather than splitting, composed of tightly meshed hyphae running parallel to the gleba; epicutis 160-250 µm; subcutis pseudoparenchymatous, 130-150 µm; gleba white and firm in youth with percurrent columella, the chambers stuffed with spores, bright luteous becoming drab luteous in age; spore mass filling chambers, powdery and friable, hydrophobic as in puffballs; clamp connections present, basidia 28-45 x 7-9 µm, irregularly shaped, 4-8 spored. Spores globose to subglobose, covered with conspicuous conical to flattened warts, prominent sterigmatal appendages in basal view (Fig. 11), 0.3-0.5 µm, spores measure (7.5) 8-11 µm; highly refractive, inamyloid; odor distinctive, strong and penetrating, produced by the mycelial mat as well.

This is one of the few false truffles found to fruit gregariously in all months of the year. It is primarily associated with the litter layer of ponderosa pine and is rarely recoverd from the mineral soil.

COLLECTIONS EXAMINED: Coconino County--Paradise Rd., Flagstaff, *States* AHF124, AHF173, AHF285, AHF302; Walnut Canyon, *States* AHF304; Mormon Lake, *States* AHF136; Anderson Mesa, *States* AHF183; Happy Jack Ranger Sta., *States* AHF227.

18. *SEDECULA PULVINATA* Zeller, *in* Zeller, Mycologia 33:213. 1941.

Characteristics of the basidiocarps compare favorably with the type. The dehiscent peridium often separates as a whole when excavated from the soil. The sublamellate gleba, if exposed in moist soil will become gelatinous rather than strictly powdery as described. The golden to dark brown spores measure 20-27 x 11-15 µm and possess a prominent eccentric basal hilum as illustrated in Fig. 12.

Deeply subterranean but occasionally near the soil surface beneath deep ponderosa pine litter. Uncommon, even in wet years, but it can be locally abundant as indicated by the spores in feces of mycophagous squirrels.

COLLECTIONS EXAMINED: Coconino County-North Kaibab Plateau at Jacob Lake, *States* AHF114.

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LITERATURE CITED

Fogel, R. and J.M. Trape. 1976. Additions to the hypogeous mycoflora of Colorado. I. Ascomycetes. Mycotaxon 4:211-217.

Harrison, K.A. and A.H. Smith. 1968. Some new species and distribution records of *Rhizopogon* in North America. Can. J. Bot. 46:881-898.

Hosford, D.R. 1975. Taxonomic studies on the genus *Rhizopogon*. I. Two new species from the Pacific Northwest. Nova Hedwegia 51:163-169.

Hosford, D.R. and J.M. Trappe. 1980. Taxonomic studies on the genus *Rhizopogon*. II. Notes and new records of species from Mexico and Caribbean countries. Bot. Soc. Mex. Mic. 14:3-15.

Ridgway, R. 1912. Color standards and color nomenclature. Publ. by the author, Washington, D.C. 43 p., 53 pl.

Smith, A.H. 1966. Notes on *Dendrogaster, Gymnoglossum, Protoglossum* and species of *Hymenogaster*. Mycologia 58:100-124.

Smith, A.H. and S.M. Zeller. 1966. A preliminary account of the North American species of *Rhizopogon*. Mem. N.Y. Bot. Gard. 14:1-180.

Smith, A.H., H.V. Smith and N.S. Weber. 1981. How to know the non-gilled mushrooms, 2nd ed. Wm. C. Brown Co. Publishers, Dubuque.

States, J.S. 1983. New records of hypogeous Ascomycetes in Arizona. Mycotaxon 14:396-402.

Stewart. E.L. 1974.

Trappe, J.M. and G. Guzman. 1971. Notes on some hypogeous fungi from Mexico. Mycologia 63:317-332.

Zeller, S.M. 1939. New and noteworthy Gasteromycetes. Mycologia 31:1-32.

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TAXONOMIC NOTES ON SOME POWDERY MILDEWS (III)

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The present paper includes the following descriptions and combinations: Leveillula duriaei (Lév.) comb. nov., Leveillula chrozophorae spec. nov., Podosphaera clandestina var. aucupariae (Erikss.) stat. nov., and Podosphaera tridactyla var. pruni-ulmifoliae (Golovin) stat. nov. A short survey of the genus Podosphaera is given.

(1) Notes on the genus Leveillula

The taxonomy of the genus Leveillula is very complicated. There are specialized as well as polyphagous races. Some taxa, recognized as species (Braun 1980), are morphologically well discriminated, mostly by the features of the conidial state (e.g. L. saxaouli or L. verbasci). The large rest of uniformly characterized forms has been comprehended in the collective species Leveillula taurica emend. Braun (l.c.). This difficult complex can only be split on the basis of detailed, especially experimental investigations. Golovin´s (1956) system to create a single species for each host family is too simple and not practicable. The limits of a single species can be narrower or wider.

Braun (l.c.) recognized Leveillula geraniacearum Eliade on the basis of the described characteristics of the asci. Recently I have revised the type of this species (BUCM 5048). The asci are extremely variable and the size does not agree with the data published in the original description. They are 60-100 x 25-50 µm, 2-spored, 30-38.5 x 19-24 µm. Therefore, L. geraniacearum should be included in L. taurica emend. Braun.

The Phlomis Leveillula is well characterized by fairly wide conidia. I supposed that it is an independent species, but without additional features for a separation I preferred to postpone this question and placed the fungus in L. taurica emend. The data in the recent paper of Rostam (1983) elucidated the situation. The surface of the conidia, seen with a scanning electron microscope, shows a fine low net of ridges (Rostam l.c., p.122, fig. 1-3). The conidial surface in some other forms, belonging to *L. taurica* emend. Braun, is composed of coarse ridges and irregular warts. Furthermore, the *Leveillula* on *Phlomis* is a biologically specialized race. It should be regarded as an independent species:

Leveillula duriaei (Lév.) U. Braun comb. nov.

Bas.: *Erysiphe duriaei* Lév., Ann. Sci. Nat., bot., 3 sér., 15, p.165 (1851).

The *Leveillula* on *Chrozophora* (Euphorbiaceae) is a very marked form (cf. Braun, l.c., p.574). It differs from most forms of *L. taurica* emend. Braun, including some races on other genera of the Euphorbiaceae, by fairly wide primary conidia (45-60 x 14-24 µm, l/w ca. 2.4-2.8). Some authors published corresponding results (e.g. Vasjagina & al. 1961, Saad & al. 1972). Forms of *Leveillula* on *Euphorbia* possess rather slender conidia (ca. 40-60 x 12-18 µm). I have studied a collection on *Chrozophora tinctoria* (L.) Juss. from LE. It is selected to serve as type of the new species.

Leveillula chrozophorae U. Braun spec. nov.

Syn.: *L. taurica* auct. p.p.

Amphigenum, mycelium dense tomentosum. Conidiis primariis late lanceolatis et conidiis subsequentibus ellipsoideis - cylindraceis, 45-60 x 15-24 µm. Cleistotheciis ca. 160-200 µm diam., appendicibus numerosis, ramosis, hyalinis, tenuitunicatis, septatis, Ascis numerosis, 60-100 x 24-38 µm, ascosporis 2, 27-40 x 15-20 µm.

Holotypus: hospes - *Chrozophora tinctoria* (L.) Juss., U.S.S.R., Azerbaizhan (LE).

The cleistothecia agree largely with *L. taurica*. The appendages are about as long as the cleist. diam. or shorter, interlaced with the mycelium. They are branched in a coral-like manner. The cells of the ascocarps are irregularly shaped, small and obscure.

(2) A short survey of the genus *Podosphaera*

Key to the recognized species

1. Appendages ± equatorially inserted, not fasciculate (sect. *Podosphaera*) 2

1' Appendages inserted in the upper half of the fruit body, ± fasciculate (sect. Tridactyla Homma ex Braun) 7

2. Apex of the appendages only 1-2 (-3) x branched, primary branches ± recurved, appendages long and flexuous, 1.5-8 x diam. cleist., hyaline and mostly aseptate, on *Hamamelis virginiana*, N. America (fig. 1) .... *P. biuncinata* Cooke & Peck (J. Bot. II, 1, p.11, 1872)

2' Apex richly branched, usually 3-6 x, a different mode of branching, on other hosts 3

3. Cleistothecia 55-75 µm diam., 4-12 appendages, 1-1.5 x diam. cleist. long, hyaline or only coloured at the very base, 0-1-septate, tips of the ultimate branchlets recurved (fig. 2), on *Viburnum*, Japan .... *P. viburni* Braun (Mycotaxon 15, p.138, 1982)
   Note: The species has been described on *Viburnum wrightii* Miq. Tanda (1983) recorded a Japanese collection of this fungus on *V. phlebotrichum* Sieb. & Zucc.

3' Appendages septate and/or coloured, on other hosts 4

4. Appendages yellowish below and hyaline above, cleistothecia 73-102 µm diam., 8-12 appendages, 1.5-2 x diam. cleist. long, apex 2-4 x branched, on *Cornus alba*, Far East of the U.S.S.R. .... *P. corni* Bunkina (Kom. Čtenija, Vladivostok, 21, p.84, 1974)

4' Appendages always dark brown in the lower half when mature, on other hosts 5

5. Ascospores small and subglobose, 13.5-20 x 10-14 µm, cleistothecia (55-) 60-85 (-90) µm diam., 3-8 appendages, ca. 1.5-2.5 x diam. cleist. long, on Erineum-galls of *Betula*, infections very inconspicuous (fig. 3) .... *P. erineophila* Naum. in Jacz. (Karm. opred. grib., mučnisto-rosj. griby, p.110, Leningrad 1927)
   Note: I have reexamined the holotype of the species (ex herb. LE). A second collection of this very rare fungus has been described and illustrated from China by Zhao (1979).

5' Ascospores large, about 18-30 x 10-19 µm, not subglobose, not on Erineum-galls, on other hosts 6

6. Appendages long, 1.5-10 x diam. cleist., on Ericaceae (*Vaccinium*) .... *P. myrtillina* (Schub. : Fr.) Kunze, in Kunze & Schm. (Mycol. Hefte 2, p.111, 1823)
   6.1. Appendages about 1.5-6 x as long as the cleist. diam., mostly rather stiff .... var. *myrtillina*
   6.1' Appendages very long and always flexuous, mostly about 5-10 x diam. cleist., especially on *V. uliginosum* .... var. *major* Juel (Öfv. k. Sv. Vet.-akad. förh. 51, p.496, 1895. Syn.: *P. major* (Juel) Blumer)
   Note: The separation between *P. myrtillina* and *P. major* is sometimes difficult, especially in N. American material. There are intermediate forms. Some hosts, especially *V. vitis-idaea*, have been recorded as hosts for both species (cf. Mäkinen 1969). Both taxa are very closely related. The intermediate collection can only be classified as *P. myrtillina* s.l. Therefore, I prefer to reintroduce the separation of both races as varieties.

6' Appendages 0.75-3.5, mostly 1-3 x diam. cleist. long, on Rosaceae .... *P. clandestina*

(Wallr. : Fr.) Lév. (Ann. Sci. Nat., bot., 3 sér., 15, p.136, 1851. Syn.: *P. minor* Howe, *P. amelanchieris* Maurizio)

6'1. Conidia ± ellipsoid, ca. (22-) 25-33 (-35) µm long and 11-16 (-18.5) µm wide, on different host genera (*Crataegus*, *Spiraea*, *Prunus*, *Amelanchier*, *Mespilus*, *Pyrus*, *Malus*, *Aronia*) var. *clandestina*

6'1' Conidia constantly shorter, broadly ellipsoid, ca. 21-26 (-29) x 12.5-17.5 µm, on *Sorbus aucuparia* .... var. *aucupariae* (Erikss.) U. Braun stat. nov. (Bas.: *P. aucupariae* Erikss., F. paras. scand. 233, 1886)

Note: I have investigated rich material of the species on numerous hosts from Europe, Asia and N. America. European collections are characterized by relatively few and short appendages. American samples have often rather long and more numerous appendages (= *P. amelanchieris*). There are, however, all transitions. We have no real basis for a separation of species or varieties within this polymorphous complex. Therefore, I maintain a comprehensive *P. clandestina*. The *Podosphaera* on *Sorbus* is the only race with slight, but constant differences. It possesses smaller conidia. Descriptions and illustrations have been published by Braun (1982). This race is, however, hardly more than a variety of *P. clandestina*.

7.(1') Apex of the appendages usually simple, only rarely 1-2 x forked, on *Malus* .... *P. leucotricha* (Ell. & Ev.) Salm. (Mem. Torrey Bot. Club.9, p.40, 1900)

7' Apex frequently dichotomously branched 8

8. Appendages very long and flexuous, up to 16 x diam. cleist., on *Salix* .... *P. schlechtendalii* Lév. (Ann. Sci. Nat., bot., 3 sér., 15, p.137, 1851)

8' Appendages shorter and rather stiff, ca. 1-6 x diam. cleist., on Rosaceae (fig. 4) .... *P. tridactyla* (Wallr.) de Bary (Abh. Senkenb. naturf. Ges. 7, p.408, 1870)

8.1. Apex of the appendages mostly 2-5 x branched, primary branches frequently elongated, ascospores ca. 16-28 µm long .... var. *tridactyla*

8.1' Apex richly and closely branched, 4-6 x, primary branches usually short, ascospores ca. 14-18 µm long .... var. *pruni-ulmifoliae* (Golovin) U. Braun stat. nov. (Bas.: *P. pruni-ulmifoliae* Golovin, Tr. sredneas. Gos. Univ., nov. ser. XIV, biol. nauk, kn. 5, 1950)

Note: The length of the appendages in *P. tridactyla* is extremely variable (1-6 x diam. cleist.). Therefore, I consider *P. longiseta* Sawada (1951) as a synonym. Golovin (1956) published a good drawing of *P. pruni-ulmifoliae*. It deviates from *P. tridactyla* by richly and closely branched appendages. This species is, however, very near to the latter species. The variety seems to be the best status for this fungus.

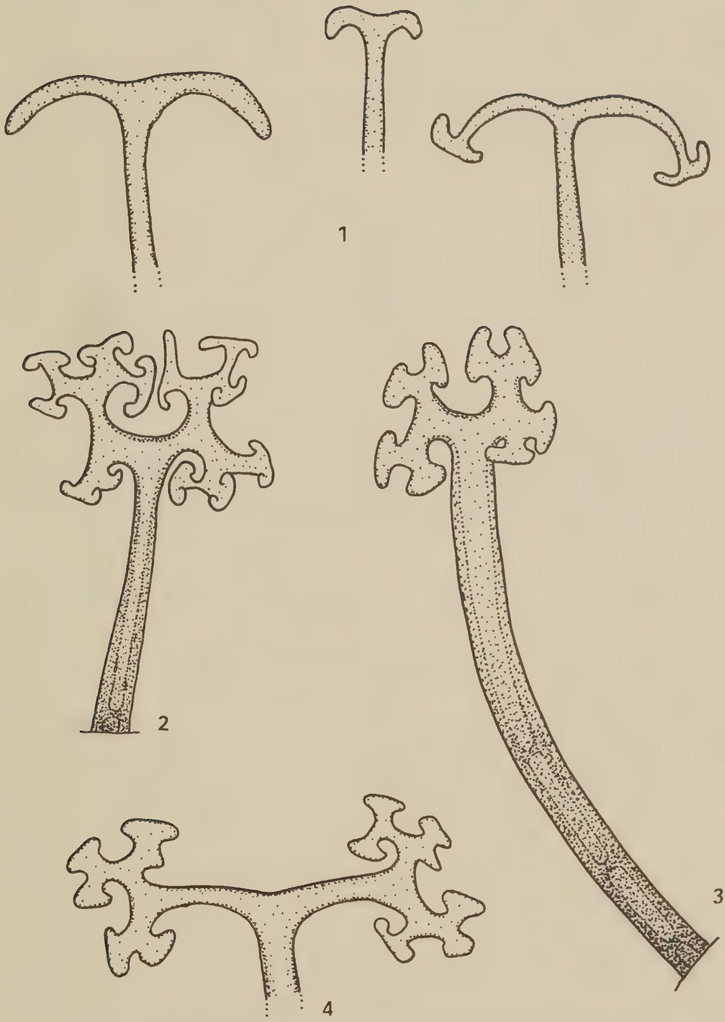

Fig. 1-4. Podosphaera biuncinata (1), apical parts of the appendages. P. viburni (2), appendage. P. erineophila (3), appendage. P. tridactyla (4), apical part of an appendage. U. Braun del.

Doubtful species: *Podosphaera schwarzmaniana* Vasjagina (1961, p.120) - the species has been described on a host of the family Apiaceae; the type is not available. *Podosphaera pruni* Golovin (Bot. mat. otd. spor. rast. 11, p. 117, 1953) - described on *Prunus* from the Far East of the U.S.S.R.; it shall be related to *P. leucotricha*; type not available; Bunkina (1979) does not include the species in the monograph of the Erysiphaceae of the Far East, although the paper (Golovin 1953) is cited.

Literature

Braun, U.: The Genus *Leveillula* - a Preliminary Study. Nova Hedwigia 32, 565-583 (1980).

—, — : Morphological Studies in the Genus Oidium (II). Zbl. Microbiol. 137, 138-152 (1982).

Bunkina, I.: Mučnisto-rosjanye griby (sem. Erysiphaceae) Dal'nego Vostoka. Vladivostok 1979.

Mäkinen, Y.: On Finish micromycetes 8. Erysiphales of Inari Lapland. Rep. Kevo Subarct. Res. St. 5, 109-116 (1969).

Rostam, S.: Biologie, écologie, systématique de quelques *Leveillula* (Ascomycètes, Erysiphacées). These, Univ. P. Sabatier. Toulouse 1983.

Saad, A., Abul-Hayja, Z. & Sonmez, M.: Investigations on *Leveillula* species in Lebanon. Actas III Congr. Un. fitopat. medit. Oeiras, 22-28, Outubero, 147-154 (1972).

Sawada, K.: Researches on Fungi in the Tohoku District of Japan (I). Erysiphaceae. Bull. Govt. For. Exp. Stat. 50, 97-140 (1951).

Tanda, S.: Mycoflora in the Okutama Experimental Forest of Tokyo University of Agriculture and its Environs. J. Agric. Sci., Tokyo Nogyo Daigaku 27(3), 214-232 (1983).

Vasjagina, M., Kuznecova, M., Pisareva, N. & Švarcman, S.: Mučnisto-rosjanye griby. Fl. spor. rast. Kazahstana III. Alma-Ata 1961.

Zhao, Z.: Flora of the Erysiphaceae in Xinjiang. Xinjiang 1979.

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DESCRIPTIONS OF NEW SPECIES AND COMBINATIONS IN MICROSPHAERA AND ERYSIPHE (V)

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The present paper contains combinations and descriptions of the following new species and varieties: Microsphaera trifolii (Grev.) Braun var. desmanthi var. nov., M. vanbruntiana Ger. var. sambuci-racemosae stat. et nom. nov., M. hedysari spec. nov., Erysiphe geraniacearum spec. nov., E. greeneana spec. nov., E. poeltii spec. nov. and E. mayorii Blumer var. cicerbitae var. nov.

1. Microsphaera trifolii (Grev.) Braun var. desmanthi U. Braun var. nov.

Syn.: E. polygoni auct. p.p.

Mycelium amphigenum vel cauligenum. Cleistothecia 70-95 (-105) µm diam., cellulae peridii angulatae, ca. 8-20 µm diam., appendices numerosae, (5-) 10-25, rigidae vel flexuosae, diametro cleistothecii ca. 2-5 plo longiores, septatae, verruculosae, brunneae, tenuitunicatae vel moderatim crassitunicatae, ca. 5-10.5 µm latae, generaliter simplices vel ad apicem dichotome ramosae, 1-2 x, asci 3-5, 40-55 x 24-40 µm, ascosporae 3-4, 14.5-22.5 x 11-14.5 µm. Fig. 1.

Holotypus: hospes - Desmanthus brachylobus Benth., USA, St. Louis, Oct. 1886, Herb. Trelease (FH).

The ascocarps are scattered to subgregarious, appendages more or less equatorially inserted, brown when mature, paler upwards, apex mostly simple, sometimes 1-2 x loosely branched, tips not recurved.

The Desmanthus fungus is very near to M. trifolii (= Erysiphe trifolii). It differs, however, by small fruit bodies with few asci and evidently verrucose appendages. The cleistothecia of var. trifolii are (80-) 90-150 (-180) µm in diam. and the appendages are smooth to faintly rough. I investigated a second collection of the new variety from BPI. M. trifolii is relatively rare in N. America.

2. *Microsphaera vanbruntiana* Gerard var. *sambuci-racemosae* U. Braun stat. et nom. nov.

Bas.: *M. sambucicola* P. Henn., Engl. Bot. Jahrb. 29, p.148 (1901).
Syn.: *M. grossulariae* auct. p.p.

The recent epidemic spread of *M. vanbruntiana* in some European countries (European part of the USSR - Geljuta 1981; Finland - Prof. Dr. Ahti, in litt.; Romania - material studied, ex herb. BUCM) stimulated a reinvestigation of this species. The race on the type host *S. canadensis* in N. America is characterized by relatively few appendages and small ascocarps (var. *vanbruntiana* - cleistothecia ca. 65-130 µm in diam., ca. 5-18 appendages). The race on *S. racemosa* and related hosts in Asia and Europe has larger fruit bodies (ca. 100-160 µm diam.) and very numerous appendages (ca. 12-40). The author studied some collections from China on *S. williamsii* and *chinensis* (ex herb. HMAS). They agree well with var. *vanbruntiana*.

Many authors consider *M. vanbruntiana* and *M. grossulariae* as a single species (Salmon 1900, Homma 1937, Parmelee 1977). The study of the imperfect states of both species revealed, however, obvious differences. The conidiophores of *M. vanbruntiana* are straight, foot-cells 18-30 x 7-11 µm, followed by 1-2 shorter cells, rarely a longer cell and a shorter, appressoria lobed, conidia singly formed, ± cylindric, 29-38 x 13.5-20 µm (fig. 3). The conidiophores of *M. grossulariae* have foot-cells of 28-60 x 7.5-8.7 µm, long and slender, cylindric, conidia ellipsoid-cylindric, 23-33 (-35) x 12.5-17.5 µm. Both species are well distinguished and should not be lumped.

3. *Microsphaera hedysari* U. Braun spec. nov.

Syn.: *Trichocladia diffusa* f. *hedysari* Jacz. (1927, p. 314). *T. diffusa* ss. Yu & Lai (1981, p.37). *Microsphaera coluteae* ss. Ialongo (1972) p.p.

Mycelium saepe cauligenum, subpersistens. Cleistothecia (95-) 110-150 (-175) µm diam., cellulae peridii angulatae, ca. 8-20 µm diam., appendices numerosae, mycelioideae, flexuosae, diametro cleistothecii ca. 0.5-4 plo longiores, ca. 3.5-6.5 µm latae, hyalinae, 0 (-3)-septatae, tenuitunicatae - crassitunicatae, ad apicem non ramosae vel dichotome ramosae, 1-4 x, laxae, ramis ultimis recurvatis vel non recurvatis, asci 5-15, 45-75 x 30-45 µm, ascosporae (3-) 4-6 (-7), 17.5-26 (-30) x 10-14.5 (-17.5) µm. Fig. 2.

Holotypus: hospes - *Hedysarum scoparium* Fisch. & Mey., China, Xinjiang Uyg. Aut. Reg., 31-9-1974, Zhao (HMAS 39405).

The cleistothecia are usually gregarious, the appendages are rather short, crisp, irregular, undulate to geniculata, sometimes subnodulose, moderately thick-walled

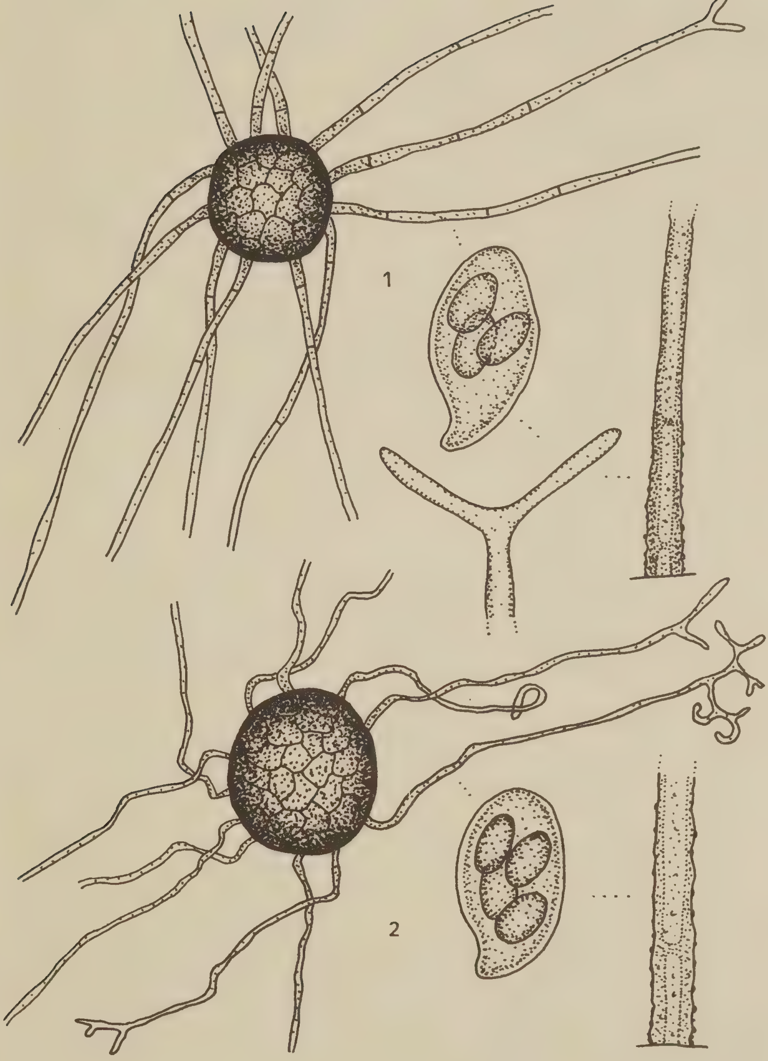

Fig. 1-2. *Microsphaera trifolii* var. *desmanthi* (1), ascocarp, ascus, apex and basis of an appendage. *Microsphaera hedysari* (2), ascocarp, ascus, basis of an appendage. U. Braun del.

throughout or thick below and thin above, apex simple or 1-3 (-4) x branched, branchings loose and irregular, tips straight or frequently recurved. The appendages are often interwoven with each other.

M. hedysari is closely related to *M. alhagi* (Golovin) U. Braun; it differs, however, by very narrow appendages. *M. coluteae* Kom. has longer appendages and a different mode of branching (fig. 4).

The author was convinced that there are two species of powdery mildews on *Alhagi* beside *Leveillula* - *Microsphaera alhagi* (Golovin) U. Braun and *Erysiphe bremeri* U. Braun (= *E. alhagi* Bremer & al. non Sorokin). The reinvestigation of this problem on the basis of new collections revealed, however, the identity of the two species. The apical branchings of the appendages develop very late and they are simple in numerous specimens. Therefore, this fungus has been treated either as a member of *Microsphaera* (= *Trichocladia*) or *Erysiphe*. But all these names refer to different developmental stages of the same species. Apical branchings are always present in fully mature samples, hence this species has to be considered as a member of *Microsphaera*.

Microsphaera alhagi (Golovin) U. Braun, Mycotaxon 14(1), p.369 (1982)

Syn.: *Erysiphe alhagi* Bremer & al., Rev. Fac. Sci. Univ. Istanbul, ser. B, 12, p.140 (1947) non Sorokin (1889 = *Leveillula*). *Trichocladia alhagi* Golovin, Tr. sredneas. gos. Univ., nov. ser., biol. nauk, 14(5), p. 7 (1950). *T. coluteae* f. *alhagi* Golovin (1960, p.127) nom. nud. *Erysiphe bremeri* U. Braun, Mycotaxon 15, p.133 (1982).

The small cleistothecial size of the species recorded in Golovin's original publication bases undoubtedly on a shortcoming. All specimens from Central Asia on the type host are characterized by large ascocarps (Dr. S. Simonian, in litt.).

4. *Erysiphe geraniacearum* U. Braun & S. Simonian[1] spec. nov.

Syn.: *E. polygoni* auct. p.p., *E. communis* auct. p.p.

Mycelium amphigenum, evanescens vel subpersistens, conidia ellipsoidea, ca. 28-34 x 14-19.6 µm. Cleistothecia sparsa vel gregaria, (75-) 80-92.5 (-98) µm diam., cellulae peridii irregulariter angulatae, 10-25 µm diam., appendices 8-12, mycelioideae, non ramosae, tenuitunicatae, septatae, hyalinae - brunneae, ca. 4-6 µm latae, diametro cleistothecii (0.5-) 1 (-2) plo longiores, asci 4-6, 40-56 x 28-36.4 µm, ascosporae 3-4, 14-19.6 x 8.4-11.2 µm. Fig. 5.

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[1] Dr. S. Simonian, Institute of Botany, Acad. Sci. of the Armenian S.S.R., 375063, U.S.S.R.

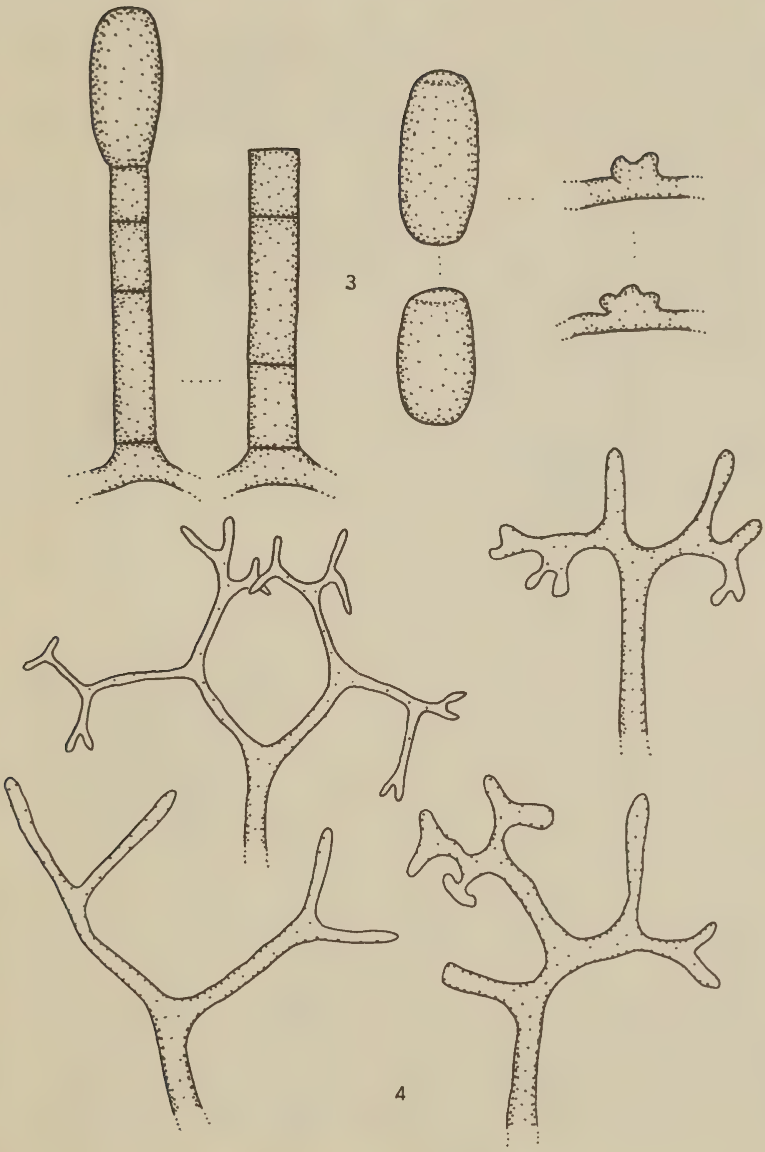

Fig. 3-4. *Microsphaera vanbruntiana* var. *sambuci-racemosae* (3), conidiophores, conidia, appressoria. *Microsphaera coluteae* (4), apical branchings of the appendages (material of the holotype, ex herb. LE). U. Braun del.

Holotypus: hospes - *Geranium pratense* L., U.S.S.R., Belorusian S.S.R., Minscaja gub., i ujezd im. Marjanovo, siroi lug, leg. Ju. Schembel, sub *E. polygoni* (LE).

Paratypus: hospes - *Geranium sylvaticum* L., (exs. F. paras. scand., Holmiae, 23-9-1882, leg. Haeggblom), sub *E. polygoni* (LE).

The mycelium is cobwebby, the appendages are inserted in the lower half of the ascocarp, length variable, brown, paler upwards, mycelioid, simple, sometimes geniculate. The species is related to *E. krumbholzii* U. Braun and *E. thuemenii* U. Braun (distinguished by the colouring of the appendages or larger ascospores). The description of "*E. communis* f. *geraniacearum*" in Braun (1980) bases very probably on a collection of a wrongly identfied host. The leaf fragments (ex herb. LE) pertain seemingly to *Ranunculus* and not to *Geranium* and the fungus is *E. aquilegiae* var. *ranunculi* (Grev.) Zheng & Chen. There is a second species of *Erysiphe* on *Geranium* belonging to *Erysiphe* sect. *Galeopsidis* U. Braun (Homma 1937, Boesewinkel 1979). It is studied at present by Prof. Dr. Zheng, Dr. S. Simonian and the author. It will be treated in a separate paper.

5. *Erysiphe greeneana* U. Braun spec. nov.

Syn.: *E. cichoracearum* auct. p.p.
Etym.: H. C. Greene, American mycologist.

Mycelium amphigenum, conidia catenulata, ± ellipsoidea, ca. 26-34 x 12-18 µm. Cleistothecia sparsa, 85-145 µm diam., cellulae peridii irregulariter formatae, ca. 6-28 µm diam., appendices numerosae, mycelioideae, diametro cleistothecii 0.5-2 plo longiores, contextae et cum mycelio intertextae, septatae, tenuitunicatae, brunneae, ca. 4.5-10.5 µm latae, asci 6-20, 50-85 x 25-40 µm, ascosporae 2(-3), 18-25 x 9.5-15.5 µm. Fig. 6.

Holotypus: hospes - *Parietaria pennsylvanica* Muhl., U.S.A., Stockton, Kans., Aug. 15, 1892, Barth., Ell. et Ev., Fungi Columb. 1822 (CUP).

Paratypi: hospes - *P. pennsylvanica*, U.S.A., Gibraltar Rock, Columbia Co., Wisc., June 28, 1938, Greene (CUP) and Madison, Dane Co., Wisc., 30-7-1944, Greene (ARIZ).

The species is clearly distinguished from *E. cichoracearum* and related taxa by the appearance of the mycelium and the scattered ascocarps. The numerous appendages form a dense felt around the fruit bodies. I observed some conidiophores with foot-cells of about 60-70 µm in length followed by a very long secondary cell of ca. 90-100 µm. These features should be studied on the basis of fresh collections.

6. *Erysiphe poeltii* U. Braun spec. nov.

Syn.: *E. polygoni* auct. p.p.

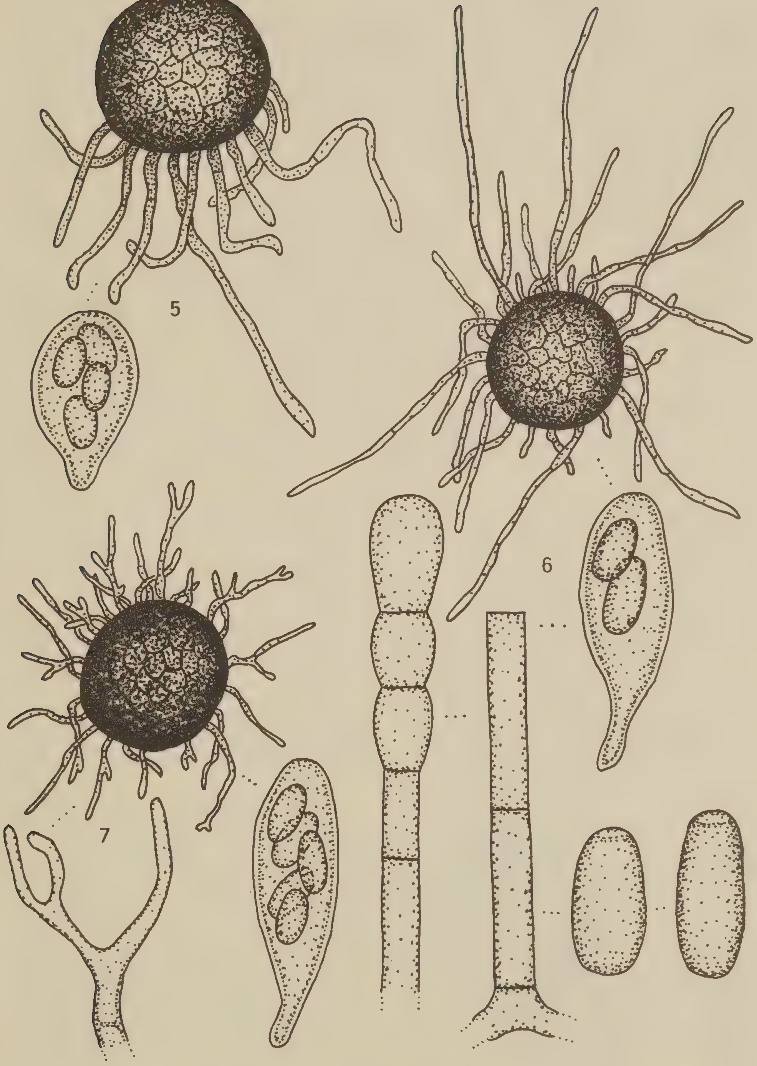

Fig. 5-7. *Erysiphe geraniacearum* (5), ascocarp, ascus. *E. greeneana* (6), ascocarp, ascus, conidiophore, conidia. *E. mayorii* (7), ascocarp, ascus, appendage. U. Braun del.

Etym.: Prof. Dr. Poelt (Graz, Austria), German mycologist and lichenologist.

Mycelium epiphyllum, evanescens vel subpersistens, conidia ellipsoidea (-ovoidea), ca. 26-33 x 13-18 µm. Cleistothecia sparsa (-subgregaria), 75-110 µm diam., cellulae peridii irregulariter angulatae, 8-25 µm diam., appendices ca. 5-20, saepe 8-15, mycelioideae, non ramosae, diametro cleistothecii (0.5-) 1-6 plo longiores, septatae, tenuitunicatae, hyalinae - brunneae, ca. 3-9.5 µm latae, asci (3-) 4-5 (-6), 45-65 x 30-40 (-55) µm, ascosporae 5-8, 16-22.5 x 9-14.5 µm. Fig. 8.

Holotypus: hospes - Hydrangea arborescens L., U.S.A., Rock Creek, Washington D.C., Oct. 7, 1891, Waite (BPI).

Paratypus: hospes - H. arborescens, U.S.A., Cabin John Run at River Rd., Md., Oct. 24, 1936, Stevenson (BPI).

The conidia are singly formed, appressoria lobed, the appendages are not interwoven, hyaline, later coloured, yellowish to brown, paler upwards. There is no closely related species. E. poeltii, confined to N. America, is well characterized by small ascocarps with well developed long appendages and asci with numerous small spores. The cleistothecia are always scattered.

7. Erysiphe mayorii Blumer var. cicerbitae U. Braun var. nov.

Syn.: E. mayorii auct. p.p., E. polygoni auct. p.p. E. communis auct. p.p.

Cleistothecia similia eis typi. Ascosporae (4-) 5-6.

Holotypus: hospes - Cicerbita alpina (L.) Wallr., Romania, Distr. Prahova, Busteni, Valea Jepilor, 4-9-1971, Negrean, Herb. Myc. Rom., fasc. 38, 1880 (BUCM 4510).

Paratypi: on C. alpina, Romania, Herb. Myc. Rom., fasc. 1, 41 (BUCM 4508) and Romania (BUCM 41701).

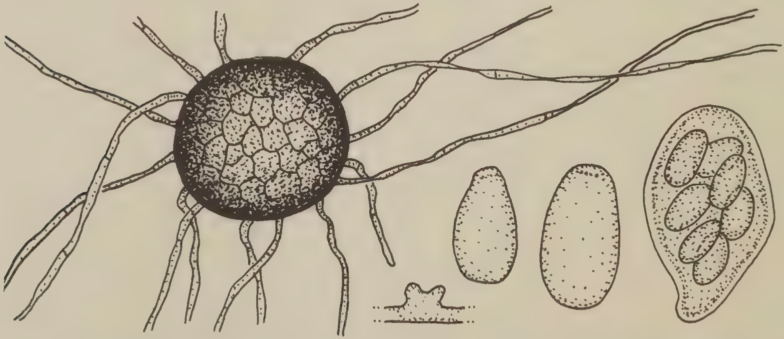

Fig. 8. Erysiphe poeltii, ascocarp, ascus, conidia, appressorium. U. Braun del.

Mycelium at stems and leaves, amphigenous, effused or patches, persistent, conidia cylindric, ca. 25-30 x 13-15 µm. Cleistothecia scattered to gregarious, (80-) 90-115 (-130) µm in diam., cells polygonal to rounded, ca. 6-20 µm diam., appendages numerous, attached to the lower half, mycelioid, interwoven, about as long as the cleist. diam. or shorter, rarely somewhat longer, septate, thin-walled, smooth to rough, ca. 3.5-8 µm wide, hyaline, later coloured, yellowish to brown, simple or frequently branched in a coral-like manner, ca. 6-16 asci, shortly stalked, 50-75 x 20-35 µm, (4-) 5-6-spored, 15-21 x 9-12 µm. Fig. 7.

This variety differs from var. *mayorii* by constantly (4-) 5-6-spored asci (var. *mayorii* 6-8 spores). It is confined to Europe (Romania, France, Switzerland). The differences between the races on *Cirsium* and *Cicerbita* have already been discussed by Blumer (1933, 1967).

Acknowledgements

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Literature

Blumer, S.: Die Erysiphaceen Mitteleuropas unter besonderer Berücksichtigung der Schweiz. Beitr. Krypt.Fl. Schweiz 7(1), 1-483 (1933).

—, — : Echte Mehltaupilze (Erysiphaceae). Jena 1967.

Boesewinkel, H. J.: Erysiphaceae of New Zealand. Sydowia 32(1-6), 13-56 (1979).

Braun, U.: Miscellaneous Notes on the Erysiphaceae (I). Feddes Repert. 91, 439-444 (1980).

Geljuta, V. P.: Novi dlja mikiflori URSR vidi rodu *Microsphaera* Lév. Ukr. bot. Z. 38(6), 50-52 (1981).

Golovin, P. N.: Mučnisto-rosjanye griby, parazitirujuščie na kul´turnyh i poleznyh rastenijah. Moskva-Leningrad 1960.

Homma, Y.: Erysiphaceae of Japan. J. Fac. Agric. Hokkaido Imp. Univ. 38, 183-461 (1937).

Ialongo, M.: Formazione dei periteci di un "mal bianco" della sulla (*Hedysarum coronarium* L.). Annali Ist. sper. Patol. Veg. (Roma) 3, 3-21 (1972).

Jaczewski, A.: Karmanii opredelitel´ gribov. Mučnisto-rosjanye griby. Leningrad 1927.

Parmelee, J. A.: The fungi of Ontario. II. Erysiphaceae (mildews). Can. J. Bot. 55, 1940-1983 (1977).

Salmon, E.: A monograph of the Erysiphaceae. Mem. Torrey bot. Club 9, 1-292 (1900).

Yu, Y.-n. & Lai, Y.-q.: Taxonomic studies on the genus *Trichocladia* of China. Acta Bot. Yunnanica 3(1), 33-42 (1981).

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A NEW SPECIES OF THE GENUS FLOSCULOMYCES

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Summary

In this paper a second species of the genus *Flosculomyces* Sutton (Dematiaceous Hyphomycetes), *F. trilobatus* sp. nov., is described.

In March 1981, on the tropical forest litter in South Western Ivory Coast, a new Dematiaceous Hyphomycete, belonging to the genus *Flosculomyces* Sutton (1978) has been discovered. This species is the second described inside this genus. The morphological description is based on characteristics observed on natural media. The Exsiccatum is deposited at the Herbarium of the Botanical Garden of Rome (H. B. R.).

Flosculomyces *trilobatus* sp. nov.

Coloniae effusae, brunneo-nigrae, hypophyllae. Mycelium plerumque immersum. Mycelium superficiale ex hyphis septatis, levibus, brunneis, ramosis, circiter 2.5 μm crassis, compositum. Conidiophora macronematosa, mononematosa, erecta, recta vel modice flexuosa, ramosa, plerumque 3-septata, ex hyphis superficialibus singulatim orientia, levia, atrobrunnea, 45-65x2.7-3.5 μm. Cellulae conidiogenae holoblasticae, integratae vel discretae, infra septa formatae, determinatae, leves, ad basim brunneae, pallidiores et tenuitunicatae ad apicem, 7-9 μm longae, 3-3.5 μm ad basim crassae, ad apicem 4.5-5.5 μm, in medio constrictae et 2.2-2.7 μm crassae, post conidiogenesis ad apicem cupulatae. Conidia 3 ex cellulis composita, rotunda modice lobata, horizontaliter complanata, septis radiatis, crassis et atrobrunneis praedita, levia, brunnea, 11.5-13.5 μm diam et 7-9 μm crassa.

In foliis emortuis, Tai, Ora Eboris, 23.3.1981, holotypus: H.B.R. 124A

Colonies effuse, blackish-brown, hypophyllous. Mycelium mostly immersed. Superficial mycelium composed of septate, smooth, dark brown, branched hyphae, about 2.5 μm wide. Conidiophores macrone-

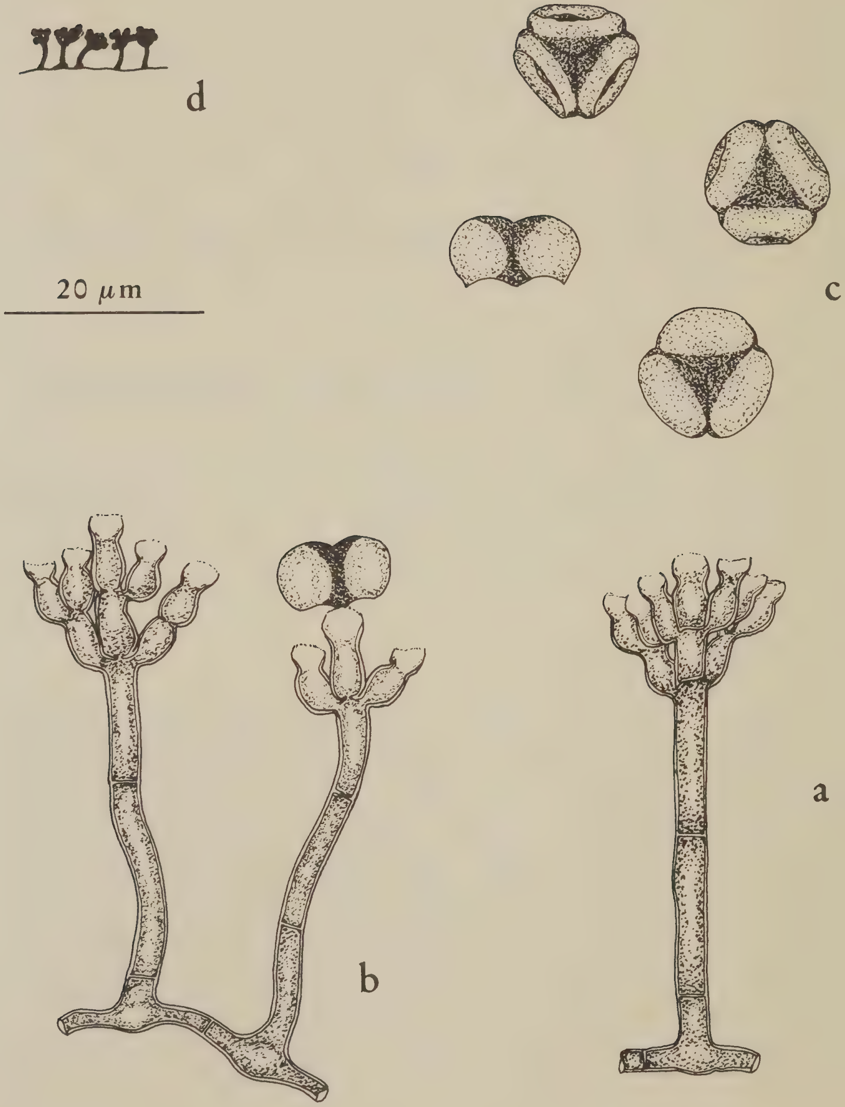

Fig. 1 - Flosculomyces trilobatus: a. and b. Conidiophores; c. Conidia; d. Habit sketch.

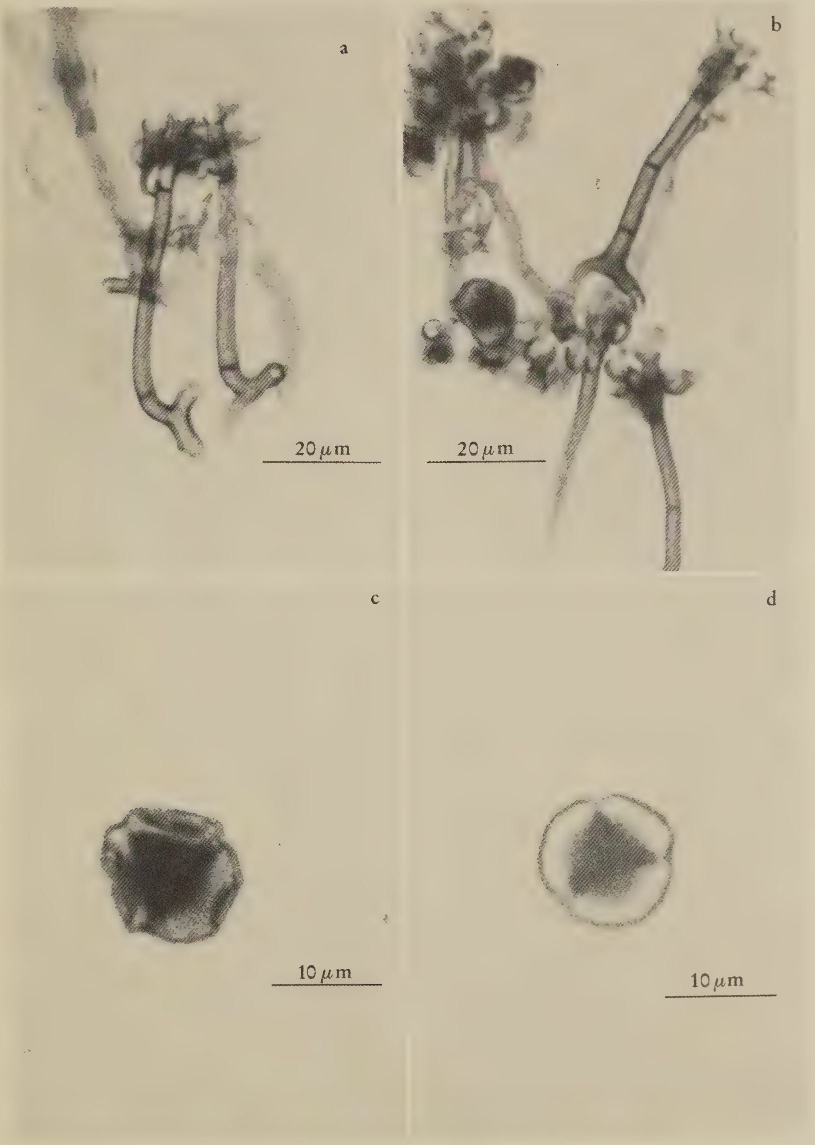
a
b
20 µm
20 µm
c
d
10 µm
10 µm

Fig. 2 - Flosculomyces trilobatus: a. and b. Conidiophores; c. and d. Conidia.

matous, mononematous, erect, straight or lightly flexuose, 1 or, more commonly, 2 time branched in the upper part, mostly 3-septate, arising singly from the superficial mycelium, smooth, dark brown, 45-65x2.7-3.5 μm. Conidiogenous cells holoblastic, integrate in the main axis or branches, or discrete, arising immediately below the septa , on the main axis or branches of the conidiophore, determinate, smooth, brown at the base, paler and thinner walled toward the apex, 7-9 μm long, 3-3.5 μm wide at the base, 4.5-5.5 μm at the apex, constricted to 2.2-2.7 μm wide in the middle, after conidiogenesis they become cupulatae. Conidia 3-celled, round, moderately lobed, horizontally flattened, radially septate: septa blackish-brown and thickened at the conidia base; smooth, dark brown; 11.5-13.5 μm diam and 7-9 μm wide.

The genus Flosculomyces was established by Sutton (1978) for the species F. floridaensis. The species here described can be included in this genus. It presents affinities with the type species in the shape of the conidiophores, of the conidiogenous cells, of the spores and in its conidiogenesis. It differs from F. floridaensis in the smaller dimensions, in the more regular type of branching of the conidiophores, and in the morphology of the spores, which are 3-celled and never 4-celled.

For the above mentioned reasons F. trilobatus is proposed as a new species.

This research has been carried out within the Tai project: Effects of increasing human activities on South Western Ivory Coast tropical rain forest, UNESCO, M.A.B. Program, Project n° 1.

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The author whishes to thank the Minister of Scientific Research of the Ivory Coast for the assistance he has given and Prof. Onorato Verona, Istituto di Microbiologia Agraria e Tecnica, Università di Pisa, Italy, for kindly reviewing the manuscript. He also thanks Prof. Angelo Rambelli for his collaboration and criticism.

REFERENCES

Sutton, B.C. (1978). New and interesting Hyphomycetes from Tampa, Florida. Mycologia 70:784-801.

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THE GENUS CANDELABROCHAETE (CORTICIACEAE) IN NORTH AMERICA AND A NOTE ON PENIOPHORA MEXICANA

By

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SUMMARY

Studies of wood-rotting Basidiomycetes for the purpose of clarifying taxonomic limits and biological similarities or differences among the taxa led me to investigate the genus *Phanerochaete* Karst., a genus containing numerous white-rot species. During that study, I noted the similarity of *Ph. septocystidia* (Burt) Eriksson and Ryvarden, *Ph. insolita* Burds. and Nakas., and *Peniophora mexicana* Burt to the genus *Candelabrochaete* Boidin. I then examined the genus *Candelabrochaete* to establish generic differences from *Phanerochaete* and to determine *Candelabrochaete*'s specific components. Such knowlege will enable more reliable determination of fungi in these genera, which are used in the study of forest pathology, wood products decay, and wood biodeterioration or bioalteration. As a result of this study, a key to and descriptions of the North American species of *Candelabrochaete* and a discussion of *Pe. mexicana* are presented here. Methods followed are those cited in Burdsall and Nakasone (1981).

INTRODUCTION

Candelabrochaete was proposed for the new species, *C. africana* Boidin, the type species, and *Hypochnus langloisii* Pat. Both occur on hardwoods in south temperate to subtropical habitats. The genus is similar to *Phanerochaete* in possessing simple septa in the subicular hyphae and at the base of the basidia, and hyaline, thin-walled, nonamyloid basidiospores. The generic characters of *Candelabrochaete* differ from *Phanerochaete*, however, by including small, cylindrical to clavate basidia, septate cystidia, a loosely interwoven subiculum, and a loosely organized hymenium that gives a farinaceous to woolly appearance to the basidiocarps.

Eriksson *et al*. (1981) stated that the palisade arrangement of the hymenium, the clavate basidia, and the lack of percurrent proliferation of basidia in *Ph. septocystidia* were more similar to species of *Phanerochaete* than to those of *Candelabrochaete*.

My studies of several specimens of *Ph. septocystidia* and the holotype of *C. africana* confirm most of the information reported by

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[1] Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

Eriksson *et al*. Although the hymenium is sometimes organized into a palisade in *Ph. septocystidia*, the basic hymenial structure is similar to that seen in *Candelabrochaete*. In some areas of some specimens of *Ph. septocystidia*, the palisade is much less organized than in others. The basidium shape in *Ph. septocystidia*, however, is frequently somewhat cylindrical to constricted, similar to the shape found in *C. africana*, although in some cases it is clavate.

Eriksson *et al*. (1981) considered percurrent proliferation as a character of generic importance in *Candelabrochaete*. I did not observe percurrent proliferation in any specimens of *Ph. septocystidia*, but neither did I observe it in the type specimen of *C. africana*. In my experience, percurrent proliferation occurs erratically in many species. In *Peniophora fuscomarginata* Burt, for example, some specimens and parts of other specimens possess striking examples of percurrent proliferation. In other specimens it has been impossible to demonstrate percurrent proliferation. Therefore, the character is certainly not of use as a generic character in *Peniophora*. I consider it an equally suspect character in the case of *Candelabrochaete*.

DESCRIPTION OF SPECIES

Three North American species of *Candelabrochaete* are recognized in this study. A key to the species is provided and *Peniophora mexicana*, a species with similarities to these three, is included in the key and described.

Key to species of *Candelabrochaete* and *Peniophora mexicana*

1. Basidiospores thick walled, broadly ellipsoid to subglobose. . . . . *P. mexicana*
1. Basidiospores thin walled, ellipsoid to allantoid 2
    2. Basidiospores ellipsoid . . . . *C. magnahypha*
    2. Basidiospores allantoid to broadly allantoid. 3
3. Basidiospores broadly allantoid to allantoid, 7-9.5 x 3-4 µm . . . . *C. langloisii*
3. Basidiospores allantoid 4.5-6.5 x 1.5-2 µm . . . . *C. septocystidia*

CANDELABROCHAETE LANGLOISII (Pat.) Boidin, Cah. Maboké 8:24. 1970. Fig. 1.

≡ *Hypochnus langloisii* Pat., Bull. Soc. Mycol. France 24:3. 1908.

≡ *Pellicularia langloisii* (Pat.) Rogers, Farlowia 1:101. 1943.

≡ *Botryobasidium langloisii* (Pat.) Gilbn. et Budington, J. Arizona Acad. Sci. 6:92. 1970.

= *Phanerochaete insolita* Burds. et Nakas., Mycologia 73:467. 1981.

Basidiocarp annual, effused in small patches, up to 0.25 mm thick, farinaceous to hypochnoid, adnate but easily separable; fertile area discontinuous, farinaceous to pubescent, "greyish orange" (near 5B4 or 6B4[2]), staining red with 2% KOH; subiculum very thin, byssoid, concolorous with hymenium; margin not differentiated, abrupt, irregular in outline.

2/ Burdsall and Nakasone (1981).

Hyphal system monomitic. Subiculum a loose textura intricata, hyphae 4-9(-12) μm diam, thick walled (walls up to 5 μm thick), hyaline to pale yellow, encrusted with hyaline crystals and yellow to orange granules that dissolve in KOH producing a red solution, regularly branched, long celled, simple septate; subhymenium a textura intricata, hyphae firm walled, pale yellow, short celled, frequently branched in candelabrum pattern, encrusted with orange granules that dissolve in KOH turning solution pink; pseudocystidia cylindrical, 75-200 x 9-15(-21) μm, protruding up to 150 μm, with numerous simple septa, often constricted at septa, thin walled or with slight wall thickening, encrusted at first with a nearly translucent sheath up to 4 μm thick, later developing into a thin, orange granular coating; basidia broadly clavate, 15-18 x 6.5-8 μm, hyaline, thin walled, simple septate at base, 4 sterigmate, sterigmata up to 8 μm long; basidiospores ellipsoid to broadly allantoid, 7-9.5 x 3-4 μm, hyaline, thin walled, smooth, Melzer's -, acyanophilous.

Habitat--On fallen well-decayed hardwood branches; associated with a white rot.

Distribution--Known from Florida and Louisiana.

Specimens examined--FLORIDA--HHB 9561 on Liquidambar styraciflua L., Leon County, holotype of Phanerochaete insolita (CFMR). LOUISIANA--Langlois 2968, sur bois pourri, St. Martinville, holotype of H. langloisii (FH).

Discussion--Because of the poor condition of the cystidia and basidia in the type specimen of H. langloisii, the description and illustration are from the type of P. insolita.

CANDELABROCHAETE MAGNAHYPHA (Burt) Burds., comb. nov. Fig. 2.
≡ Peniophora magnahypha Burt, Ann. Missouri Bot. Gard. 12:238. 1925 [1926].

Basidiocarp annual, effused in small patches up to 2 cm diam, appressed farinaceous to hypochnoid, adherent but easily separable; fertile area continuous, white to pale yellowish gray (near 3B2); margin abrupt, not differentiated; subiculum thin, not distinguishable.

Hyphal system monomitic. Abhymenial surface not differentiated; subiculum a loose textura intricata, hyphae (6-)9-12(-15) μm diam, thin walled to firm walled, walls occasionally up to 1 μm thick, hyaline to pale yellow, with right-angle branching, simple septate or rarely nodose septate, smooth or encrusted with small brownish yellow granules and crystals; subhymenium hyphae much branched at right angles, 3.5-4.5 μm diam, thin walled, hyaline, smooth or encrusted with brownish yellow granules and crystals, simple septate; pseudocystidia arising from subiculum, cylindrical, with frequent simple septa, 100-150 x 9-12 μm, thin walled to firm walled, walls occasionally up to 1 μm thick, usually encrusted with brownish yellow granules and crystals, sometimes smooth, embedded in subiculum and protruding up to 40 μm above basidia; basidia broadly clavate, 12-15 x 5.5-6 μm, hyaline, thin walled, simple septate at base, 4-sterigmate, sterigmata up to 5 μm long; basidiospores ellipsoid, 6-7(-8) x 3-4 μm, hyaline, thin walled, smooth, Melzer's -, acyanophilous.

Habitat--On well-decayed hardwood; apparently associated with a white rot.

Distribution--Known only from the type collection from Florida.

Specimens examined--FLORIDA--R. Thaxter 57, on wood, Coconut Grove (FH).

Discussion--*Candelabrochaete magnahypha* is not conspecific with *Candelabrochaete langloisii* as suggested in previous studies (Rogers, 1943; Boidin, 1970). The basidiocarp of *C. magnahypha* is nearly white, not grayish orange as in *C. langloisii*. In addition, *C. magnahypha* possesses subiculum hyphae that are broader, much thinner walled, and with paler crystals. Finally, the ellipsoid basidiospores distinguish *C. magnahypha* from other *Candelabrochaete* species.

CANDELABROCHAETE SEPTOCYSTIDIA (Burt) Burds., comb. nov. Fig. 3.
≡ *Phanerochaete septocystidia* (Burt) Erikss. et Ryv. in Erikss. et al., Cort. North Europe 5:1021. 1978.
≡ *Peniophora septocystidia* Burt, Ann. Missouri Bot. Gard. 12:260. 1925 [1926].
≡ *Scopuloides septocystidiata* (Burt) Jülich, Persoonia 11:422. 1982.
= *Odonticium raitviirii* Parm., Consp. Syst. Cort. p. 218. 1968 (fide Erikss. et al. 1978).

Basidiocarps broadly effuse, extending up to 8 x 4 cm, hypochnoid, thin, somewhat discontinuous; fertile area pubescent to farinaceous, pale yellowish tan, not changing color in KOH; subiculum concolorous; margin thin, white, pruinose to farinaceous.

Hyphal system monomitic. *Subiculum* a loose *textura intricata*, poorly developed or up to 250 µm thick, hyphae 4-6(-9) µm diam, thin to thick walled (walls up to 1.5 µm thick), hyaline, simple septate, noticeably constricted at septa, branching at wide angles, smooth or irregularly coated with yellow-brown granular to globular material; *subhymenium* a dense *textura intricata*, hyphae short celled, 2.5-4 µm diam, frequently branched, densely encrusted with yellow-brown granular to globular material; *pseudocystidia* cylindrical, arising in subiculum at all levels, 60-150 x 5-9(-12) µm, protruding up to 35 µm beyond basidia, simple septate, with many septa, short celled, constricted at septa, firm walled to thick walled (walls up to 1.5 µm), apical cell with thinner walls, covered with large orange-brown granular and globular material, simple septate at base; *basidia* cylindrical to clavate, sometimes constricted, 12-18 x 4.5-5.5 µm, hyaline, thin walled, simple septate at base, 4-sterigmate, sterigmata 3-4 µm long; *basidiospores* allantoid, 4.5-6.5 x 1.5-2 µm, thin walled, hyaline, Melzer's -, acyanophilous.

Habitat--On angiospermous or occasionally gymnospermous wood; associated with a white rot.

Distribution--Uncommon in eastern North America, Jamaica, and North Europe.

Specimens examined--JAMAICA--Murrill and Harris 840, HMBG 61490, Troy and Tyre, Cockpit Country (BPI), holotype of *Pe. septocystidia*. NORWAY--Ryvarden 8182, on wood, Aust-Adger, Landvik:Skiftenes (GB, CFMR). U.S.A.: NORTH CAROLINA--HHB 4207 and 4208, on *Liriodendron tulipifera* L., Haywood County (CFMR); NEW YORK--HMBG 55968, on coniferous wood, Westport County (BPI); NEW JERSEY--HMBG 63455, on *Pinus* sp., Newfield County (BPI); MICHIGAN--HHB 10319, on *Acer saccharum* Marsh., Marquette County (CFMR); MINNESOTA--RLG 9759, on *Populus balsamifera* L., (ARIZ, CFMR) and FP 100695 on *Populus* sp., both Clearwater County (CFMR); TENNESSEE--HHB 3884, on *Acer* sp., Sevier County (CFMR); WISCONSIN--FP 101895, on hardwood log, Door County (CFMR).

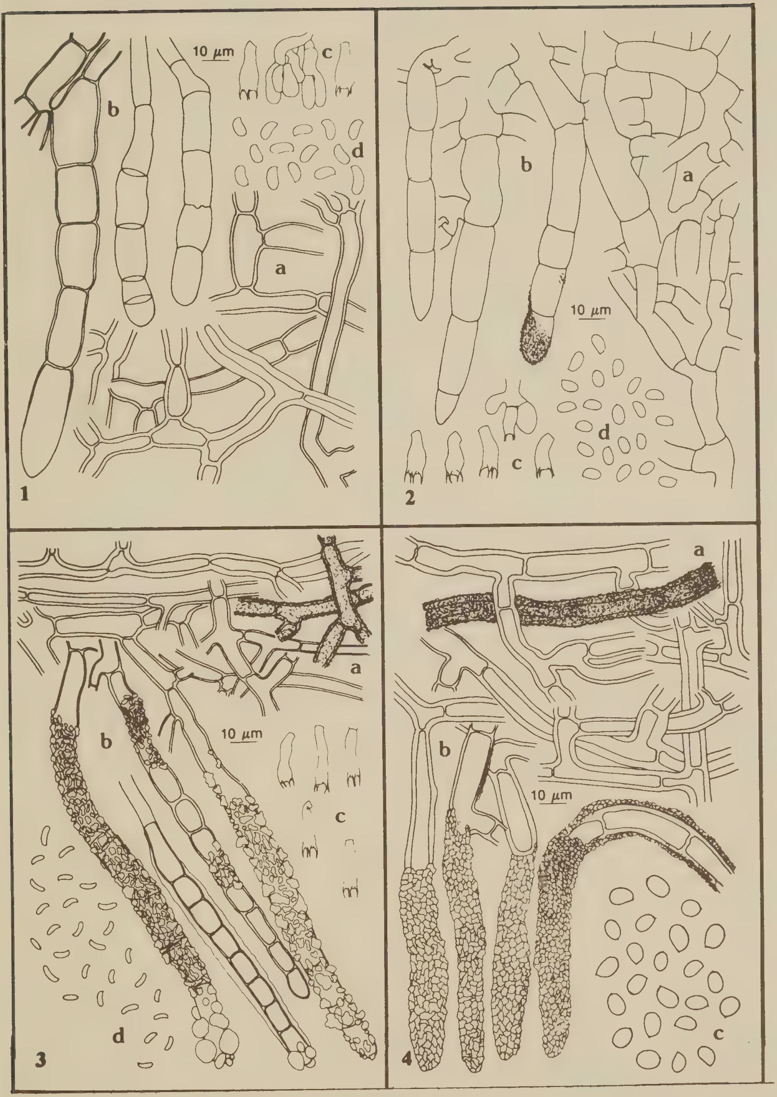

Fig. 1. Candelabrochaete langloisii. (HHB 9561 - holotype of P. insolita). a. subicular hyphae, b. cystidia, c. basidia, d. basidiospores. Fig. 2. Candelabrochaete magnahypha (holotype). a. subicular hyphae, b. cystidia, c. basidia, d. basidiospores. Fig. 3. Candelabrochaete septocystidia (HHB 10319). a. subicular hyphae, b. cystidia, c. basidia, d. basidiospores. Fig. 4. Peniophora mexicana (holotype). a. subicular hyphae, b. cystidia, c. basidiospores. (ML83 5506)

Discussion--*Candelabrochaete septocystidia* is distinguished from the other *Candelabrochaete* species by its allantoid basidiospores measuring 4.5-6.5 x 1.5-2 µm. Its distribution into the north temperate areas of North America and Europe is unusual for a species of *Candelabrochaete* because all the other species are from subtropical or south temperate regions.

Jülich's (1982) transfer of *Peniophora septocystidia* (as *P. septocystidiata*) to *Scopuloides* (Massee) Hjortst. et Ryv. (1979) because it possesses septate cystidia, is unwarranted. The basidiocarp structure and the type of cystidia of *C. septocystidia* are entirely unlike those found in species of *Scopuloides*. The septa of hyphae in the axes of the teeth of species such as *Phanerochaete* (*Scopuloides*) *rimosa* (Cooke) Burds. are not primary septa such as those found in *C. septocystidia*.

Candelabrochaete verruculosa Hjortstam (1983), not known from North America, differs from *C. langloisii* and *C. magnahypha* in possessing shorter basidiospores, although the description is similar in other characteristics. It differs from *C. septocystidia* in possessing ovoid rather than allantoid spores.

PENIOPHORA MEXICANA Burt, Ann. Missouri Bot. Gard. 12:243. 1925 [1926]. Fig. 4.

Basidiocarp broadly effuse, up to 0.25 mm thick, woolly, adherent; fertile area continuous, pubescent, "pale yellow" (4A2), not changing color in KOH; subiculum concolorous with fertile area; margin abrupt, pubescent, irregular in outline, concolorous.

Hyphal system monomitic. *Subiculum* a loose *textura intricata*, hyphae 6-12 µm diam, walls up to 3.5 µm thick, pale yellow to pale brownish yellow, smooth branching at right angles, long celled, simple septate; *subhymenium* compact, hyphae 4-6 µm diam, firm walled, pale yellow, smooth, with frequent branching, short celled, simple septate; *pseudocystidia* poorly differentiated, cylindrical, 90-150 x 9-20 µm, hyaline, aseptate, with walls up to 3 µm thick heavily encrusted with hyaline crystals, protruding up to 50 µm; *basidia* poorly preserved, not measurable, 4 sterigmate [...subcylindrical to short clavate, 9-11.5 x 6.5-7 µm, ... fide Liberta, 1968]; *basidiospores* ellipsoid to broadly ellipsoid, 7-10(-12) x (4)5-6 µm, hyaline, thick walled, smooth, Melzer's -, cyanophilous.

Habitat--On hardwood slash and debris; associated with a white rot.

Distribution--Known only from type locality.

Specimens examined--MEXICO--Murrill 773, HMBG 54633, on wood, January 10-14, 1910, Veracruz, Orizaba (Lectotype and isotype BPI, FH).

Discussion--The specimens on deposit at BPI and that at FH are portions of a single collection; however the BPI specimen cannot be located at this time.

The microscopic characters of *P. mexicana* suggest a relationship to *Phanerochaete* and *Candelabrochaete* (with broad simple septate hyphae and pseudocystidia) and to *Hypochnicium* (with thick walled spores). Because of the discrepancies, it is maintained in *Peniophora* until an appropriate generic placement is determined. It is discussed here only because of the superficial similarities (i.e. the septate cystidia).

LITERATURE CITED

BOIDIN, J. 1970. Basidiomycétes Corticiaceae de la Républic Centrafricaine II. Les genres *Botryobasidium* Donk et *Candelabrochaete* nov. gen. Cah. Maboké 8:17-25.

BURDSALL, H. H., Jr. and K. K. NAKASONE. 1981. New or little known Aphyllophorales (Basidiomycotina) from the southeastern United States. Mycologia 73:454-476.

ERIKSSON, J., K. HJORTSTAM, and L. RYVARDEN. 1981. Cort. North Europe 6:1051-1276.

HJORTSTAM, K. 1983. Studies in tropical Corticiaceae (Basidiomycetes) V: Specimens from East Africa, collected by L. Ryvarden. Mycotaxon 17:555-572.

HJORTSTAM, K. and L. RYVARDEN. 1979. Notes on Corticiaceae (Basidiomycetes) IV. Mycotaxon 9:505-519.

JULICH, W. 1982. Notes on some Basidiomycetes (Aphyllophorales and Heterobasidiomycetes). Persoonia 11:421-428.

KARSTEN, P. A. 1889. Kritish öfversigt af Finland's Basidsvamper (Basidiomycetes; Gasteromycetes; and Hymenomycetes). Bidr. Känn. Finl. Nat. Folk. 48:1-470.

LIBERTA, A. E. 1968. Descriptions of the nomenclatural types of peniophoras described by Burt. Mycologia 60:827-857.

PATOUILLARD, N. 1908. Champignon nouveaux ou peu connus. Bull. Soc. Mycol. France. 24:1-12.

ROGERS, D. P. 1943. The genus *Pellicularia* (Thelephoraceae). Farlowia 1:95-118.

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ON RHIZOIDS OF ENTOMOPHTHORA MUSCAE (COHN) FRESENIUS (ENTOMOPHTHORALES: ENTOMOPHTHORACEAE)

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SUMMARY

Contrary to hitherto widely held opinion, the formation of rhizoids by Entomophthora muscae (Cohn) Fres. was confirmed. The hyphae of the fungus grow invariably through the mouthparts and affix the host to the substratum by holdfasts which emerge from the underside of the labellum and surround it with liguliform or lobate outgrowths. The holdfasts appear during the time immediately preceding the host's death and before the sporulation of the fungus. The connection of the holdfasts and mycelium from the mouthparts with the hyphal bodies in the host's hemocoele was proven by means of dissection. The importance of holdfasts for systematics of entomophthoralean fungi is discussed and the correctness of using the term "rhizoids" in relation to the affixing structures for entomopathogenic species of this family is questioned.

INTRODUCTION

Since Entomophthora muscae (Cohn) Fresenius was first described in 1855, mycologists have uniformly believed that this fungus forms no rhizoids. This view was expressed in detailed studies on the morphology and biology of this species, and in keys for identification of the genera in serious monographs and mycology textbooks. The commonly observed attachment of the proboscis of dead flies to the substrate has been explained to result from the drying of secretions through the proboscis (Weiser 1966) or by the emergence of hyphae from the labellar lobes (Berisford and Tsao 1974). More recently, Brobyn and Wilding (1983) noted that both the hyphal bodies and unspecialized hyphae developed in the proboscis and occasionally grow out through the labellum after the host's death although these authors did not interpret these hyphae as rhizoids or holdfasts. The observations and investigations carried out in the years 1978-1981 unequivocally demonstrated that the formation of rhizoids in natural conditions is a constant feature of E. muscae.

MATERIALS AND METHODS

A wide variety of flies infected by Entomophthora muscae (Table 1) collected mostly in the Wielkopolski National Park as well as in other regions of Poland and in the Krkonošski National Park in Czechoslovakia formed the principal subject matter for these studies. Since 1976, when mycelial elements were first observed affixing the proboscis of affected flies to the substrate (e.g., windowpanes, stems, leaves, or flowers), microscopical preparations of mouthparts were made to determine the origin, nature, and morphology of these hyphae as well as their possible connections with the mycelium and hyphal bodies of E. muscae developing in the body cavity.

In order to obtain the best possible views of the holdfasts, live but infected flies were kept in small cages made of six microscope cover glasses. The insects were removed after death but the distinct arrangement of hyphae at the point of proboscis attachment was usually distinct and readily observable. In order to determine when the rhizoids first emerged, great numbers of living and dead host specimens were simultaneously collected (usually from sites of epizootic outbreaks) for dissection and comparison of the developmental phases of the pathogen. All slide preparations were made under a magnifying glass at 40-120x while more detailed observations were made with the compound microscope. Several hundred such preparations were examined, and the best of these together with their detached insects have been preserved in the mycological collection of the Forest Research Laboratory, Department of Agricultural and Forest Biology, Polish Academy of Sciences, in Poznań.

TABLE 1. Fly species infected by Entomophthora muscae observed in these studies.

HOST FAMILY	HOST SPECIES
Anthomyiidae	Eustalomyia hilaris Fall.
	Hylemya (Delia) brassicae Bouche
	Hylemya (Delia) florilega Zett.
	Hylemya (Delia) platura Meig.
	Hylemya (Paregle) cinerella Fall.
	Hylemya (Pegohylemya) fugax Meig.
	Hylemya strigosa Fabr.
	other undetermined species
Calliphoridae	Pollenia rudis Fabr.
Empididae	Three undetermined specimens
Muscidae	Musca domestica L.
	Other undetermined specimens
Scatophagidae	Scopeuma stercoraria (L.)
	other undetermined species
Syrphidae	Melanostoma scalare (Fabr.)
	Platychirus clypeatus Meig.
	Syrphus tricinctus Fall.
	Syrphus sp.
	other undetermined species

RESULTS

As in the known species of Erynia Nowakowski and Zoophthora Batko, rhizoids are the first external hyphae to appear during the development of Entomophthora muscae. These hyphae grow through the proboscis pipe and in the underside of the oral disc form a network of branched hyphae, 4.0-8.0 µm in diameter, with short irregular holdfasts underneath the labellus (Fig. 5c). The latter is surrounded with liguliform or lobate outgrowths with obtuse ends (up to 120 µm long and 20 µm wide) spreading radially in one to three layers on the substrate (Figs. 2a, 4a-b, 5b-c).

During the observations of epizootics in populations of Hylemya platura, Melanostoma scalare and some other species of the flies, it was noted that moribund individuals still making uncoordinated leg movements were firmly attached to the substrate by well developed holdfasts. The abdomens of these specimens contained innumerable globose to ovoidal hyphal bodies (Fig. 3a), many of which had germinated to produce hyphae several microns long. Apart from a few of the globose hyphal bodies described above, hyphal bodies in the thorax were mostly irregularly elongate and resembling hyphal segments (Fig. 3b). No globose hyphal bodies were observed in the heads of any of these flies whereas ellipsoidal to cylindric hyphal bodies 30-70 x 10-20(24) µm (figs. 3b, 5a) surrounded the cerebral ganglia and optic lobes. Some of these hyphal bodies perforated the membranes of the alimentary duct near the oesophagus. The presence of such morphologically distinct hyphal bodies in the head suggests that these forms multiply there. Near the basal sections of the mouth parts (rostrum), the mycelial strands assume a nearly parallel arrangement with the individual cells being 28-60(120) x 8.5-17(20) µm (Figs. 1a-c). This parallel arrangement is disrupted near the moving articulations of the mouthparts (bases of the palpi, and the connection between the rostrum and haustellum); in these sites the hyphae grow in different directions and may be polymorphic (Figs. 3c, 5a). The fungus is most prominent in the salivary duct and sometimes also partly fills the hypopharynx or labrum (Fig. 4c-d). Parallel hyphae are again found in the haustellum, but these branch out into the labellum to form the short holdfasts and outgrowths described above. The latter structures are filled with cytoplasm when first formed, but appear to be empty shortly after the death of the host. These hyphae and holdfasts devoid of cytoplasm break off easily (particularly in dry weather) when collecting cadavers. Nevertheless, their remaining fragments can usually be observed in microscopical preparations made from previously moistened insects. It is notable that the muscles of the mouthparts appear to be undamaged in both moribund and dead hosts.

DISCUSSION AND CONCLUSIONS

Although the presence or absence of rhizoids was little emphasized in the earliest descriptions of entomophthoraceous fungi, Nowakowski (1883) regarded these structures to have primary importance for separating genera in his monograph, the first systematic treatment of these fungi. Nowakowski's concepts were later adopted by Lakon (1919) and then amplified by Batko (1964a-c, 1966, 1974). On the other hand, Thaxter (1888, p. 146) and Gustafsson (1965, p. 114) both gave rather complete information on the morphology of the rhizoids of species they treated but ascribed no particular taxonomic significance to these structures. It appears from their works that neither Giard, Sorokin, nor Petch treated rhizoids as important features of entomophthoraceous fungi. In compiling their keys for species identifications, MacLeod and Müller-Kögler (1970, 1973) did not consider rhizoids to be useful characters except for the species with campanulate conidia (MacLeod et al. 1976), species which were all

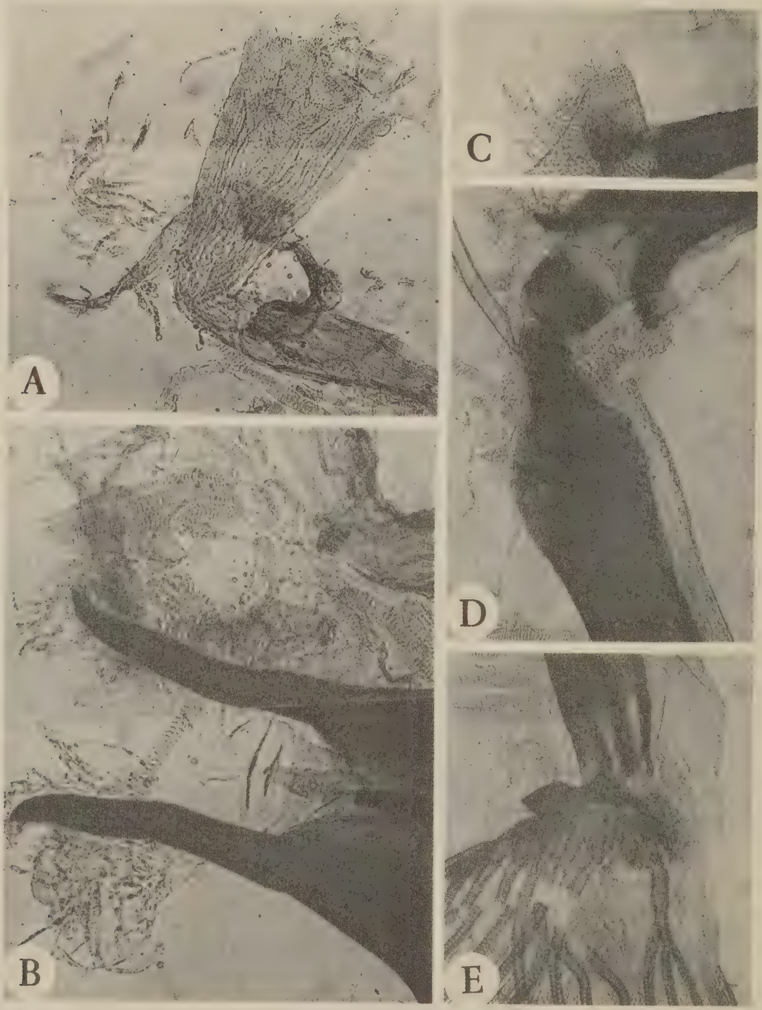
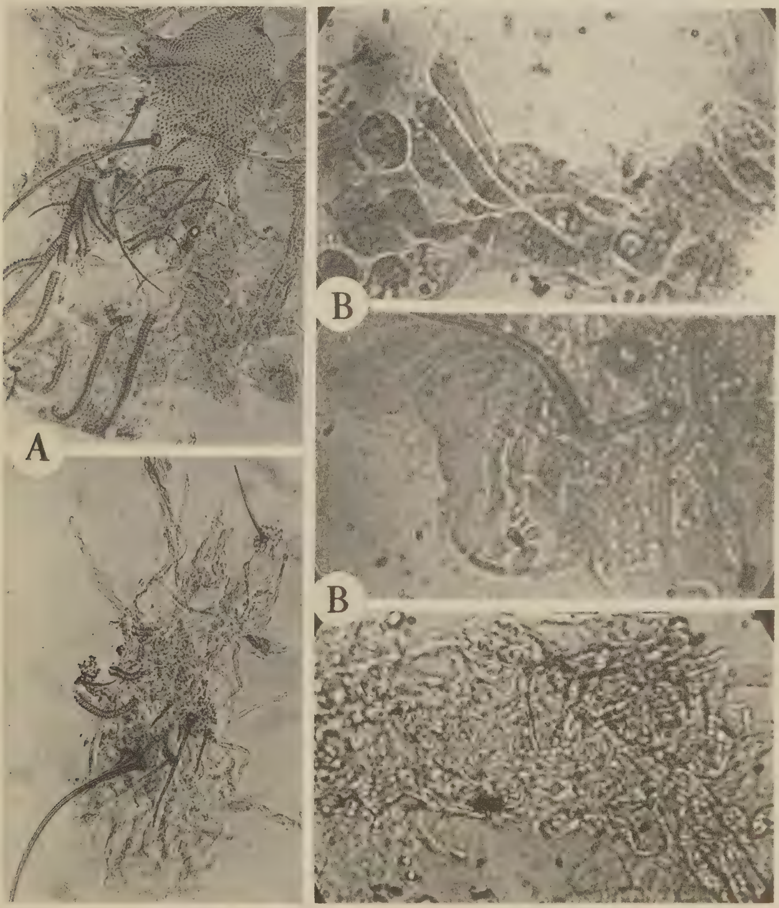


Fig. 1. *Mycelium of Entomophthora muscae in the mouthparts of Pollenia rudis at the time of sporulation of the fungus. A: Hyphae in basal part of rostrum. B: Hyphal segments at base of palpus. C: Mycelium in the joint between the rostrum and haustellum and in the "sponge" of the labellum.*

Fig. 2 (facing page). *Mycelium of E. muscae in labellum of P. rudis. A: Hyphae and holdfasts in labellum. B: Remnants of holdfasts on coverslip (greater magnification).*

later included in the genus Entomophthora Fres. s.str. (Remaudière & Keller 1980). The significance of rhizoids for entomophthoralean systematics has been considered in several recent papers (Brobyn & Wilding 1977; Remaudière & Keller 1980; Humber 1981; Ben-Ze'ev & Kenneth 1981) although the opinions and conclusions of these authors were not univocal.

It is worth noting that rhizoids occur in some species in both the polykaryotic and oligokaryotic forms of the Entomophthorales, and that their presence is limited to the entomopathogenic forms. Batko (1974) noted that the evolution of the Entomophthorales accomplished itself by the structural arrangement of the nuclear apparatus with simultaneous functional differentiation of specific parts of the thallus and proceeds from saprophytism or facultative parasitism to a more specialized pathogenicity. This sequence suggests that the appearance of structures to allow attachment of the host by the pathogen "in the



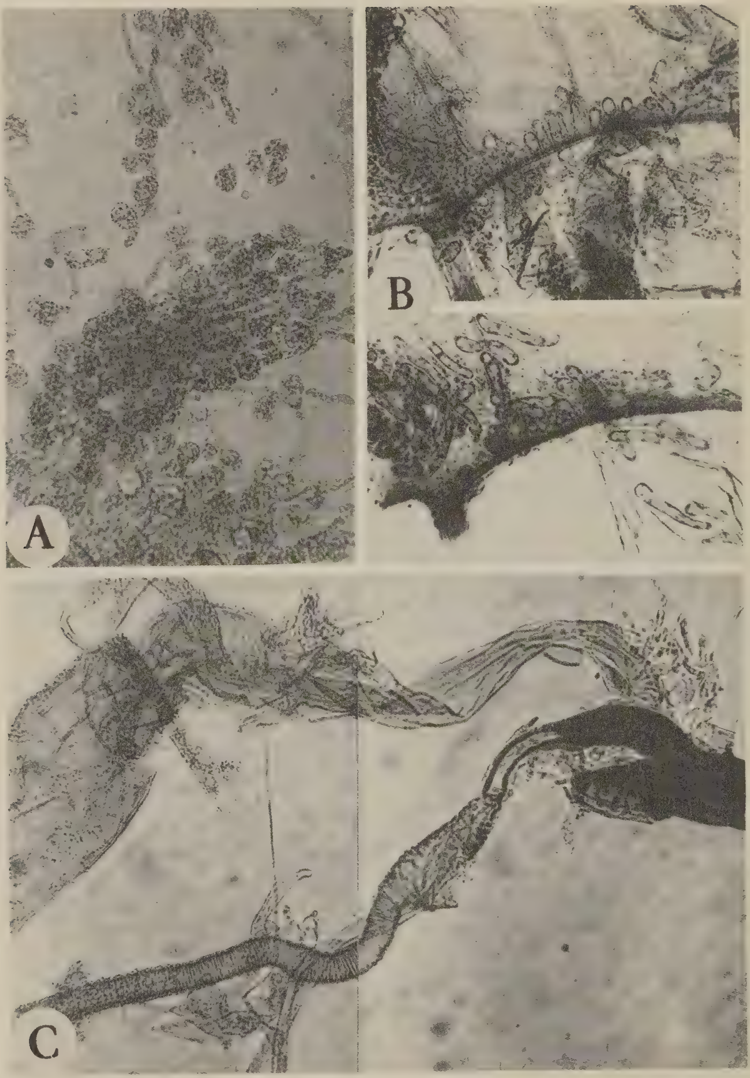
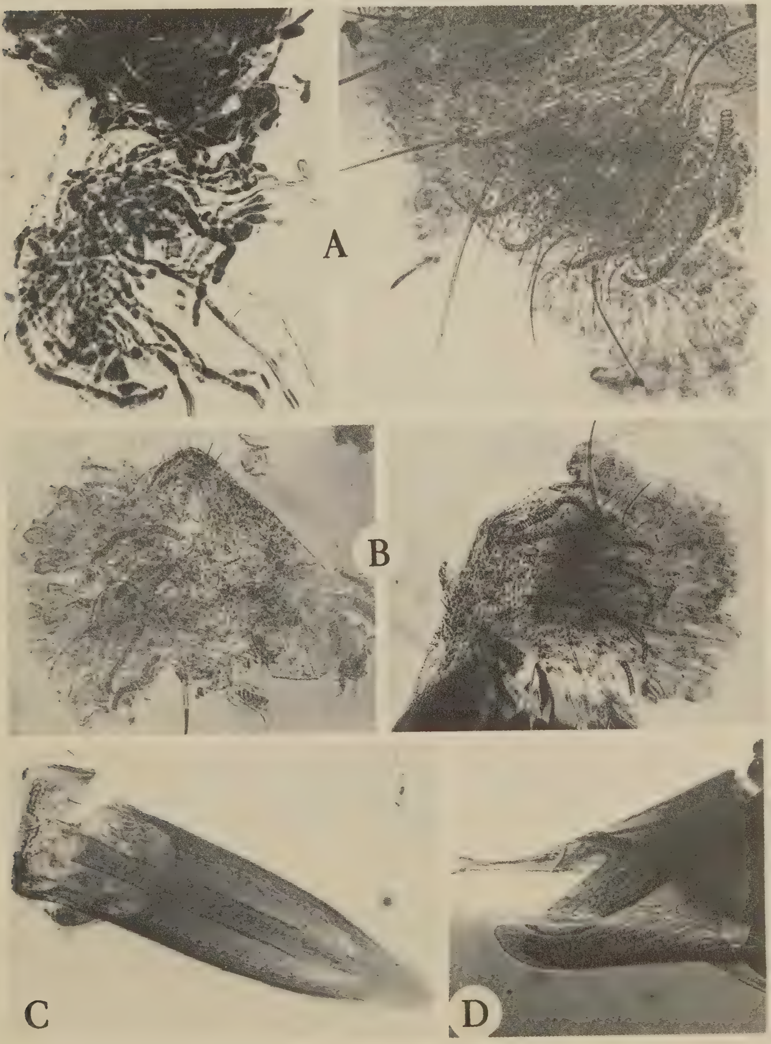


Fig. 3. *Mycelium of E. muscae inside the body of Hylemya brassicae just prior to death. A: Hyphal bodies from abdomen. B: Hyphal bodies from head. C: Mycelium by the salivary duct.*

Fig. 4 (facing page). *Mycelium of E. muscae in the mouthparts of some flies. A: Hyphae and holdfasts at the labellum of H. brassicae. B: Holdfasts at the labellum of H. florilega. C: Hyphae in the hypopharynx of Melanostoma scalare. D: Hyphae in labrum of Syrphus tricinctus.*

situation permitting the infection of further individuals of the former" (Batko 1974) should be regarded as an essential qualitative adaptation for pathogenicity. Based on our current knowledge of the Entomophthorales, this level of parasitic specialization was attained by only a few polykaryotic species whereas rhizoids became a common feature in oligokaryotic forms, principally with long periods *post mortem* development in the cadavers, e.g. species of *Entomophthora*, *Erynia*, and *Zoophthora*. As the parasitic phase increases in length, the importance of rhizoids should diminish. This corollary postulate might explain the absence of rhizoids from *Entomophthora erupta* (Dustan) Hall, *E. thripidum* Samson et al., *E. weberi* (Lakon) Batko, and *Strongwellsea* species. It would



appear, therefore, that we can speak of species being primarily or secondarily devoid of rhizoids, and that the ability of particular entomophthoralean species to form rhizoids should not be overlooked while considering the phylogeny, taxonomy, and, consequently, the systematics of this group. One cannot exclude the possibility that rhizoids do not appear in any particular instance as a result of the actions of external factors or physiological disturbances, but such cases should be treated as abnormal.

It is quite obvious for *Entomophthora* Fres. sensu Remaudière & Keller that the presence or absence of rhizoids should be a criterion for infrageneric division. The inclusion by Remaudière & Keller (1980) in *Conidiobolus* of three species forming rhizoids and of the synonymization of *Strongwellsea* in *Erynia* does not seem convincing. It is my opinion that that ability or inability to form rhizoids should be accepted as a criterion of subgeneric value. However, it can be considered in the differentiation of genera, e.g., to distinguish *Strongwellsea*, when used in combination with other essential features.

On this occasion, it would also be useful to comment on the use of the term "rhizoid" for structures in the entomopathogenic Entomophthoraceae. In the majority of mycological works, rhizoids are defined as the structures which not only attach thalli to a substrate but also serve nutritive functions (Karling 1932; Snell & Dick 1957; Hickman 1965; Moročkovskii & al. 1967). Moreover, the appearance of rhizoids should suggest some similarity to roots (Alexopoulos & Mims 1979). In the Entomophthoraceae, these structures are tape- or ribbon-like, rather thick and unbranched or scarcely branched and are usually widened at the end. In species assignable to *Zoophthora* Batko sensu Remaudiere & Hennebert 1980 (= *Erynia* Nowak. subg. *Zoophthora* Batko sensu Humber & Ben-Ze'ev 1981), rhizoids are thinner, rather thread-like, and often aggregated into synnematous fascicles with strongly tangled and somewhat root-like branched ends. Their function is never connected with obtaining nutrition but is confined wholly to assuring the emplacement of a host for the period of the pathogen's sporulation. The rhizoids of the Entomophthoraceae are, therefore, close to the "rhizina" of lichens (Ainsworth 1971). Because of these noted differences, it would seem that their designation as "holdfasts" in English, "Haftfasern" in German (Lakon 1919), and "chwytniki" or "strzepki przyczepkowe" in Polish (but not "włoski przyczepkowe" after Nowakowski 1883) would be more appropriate.

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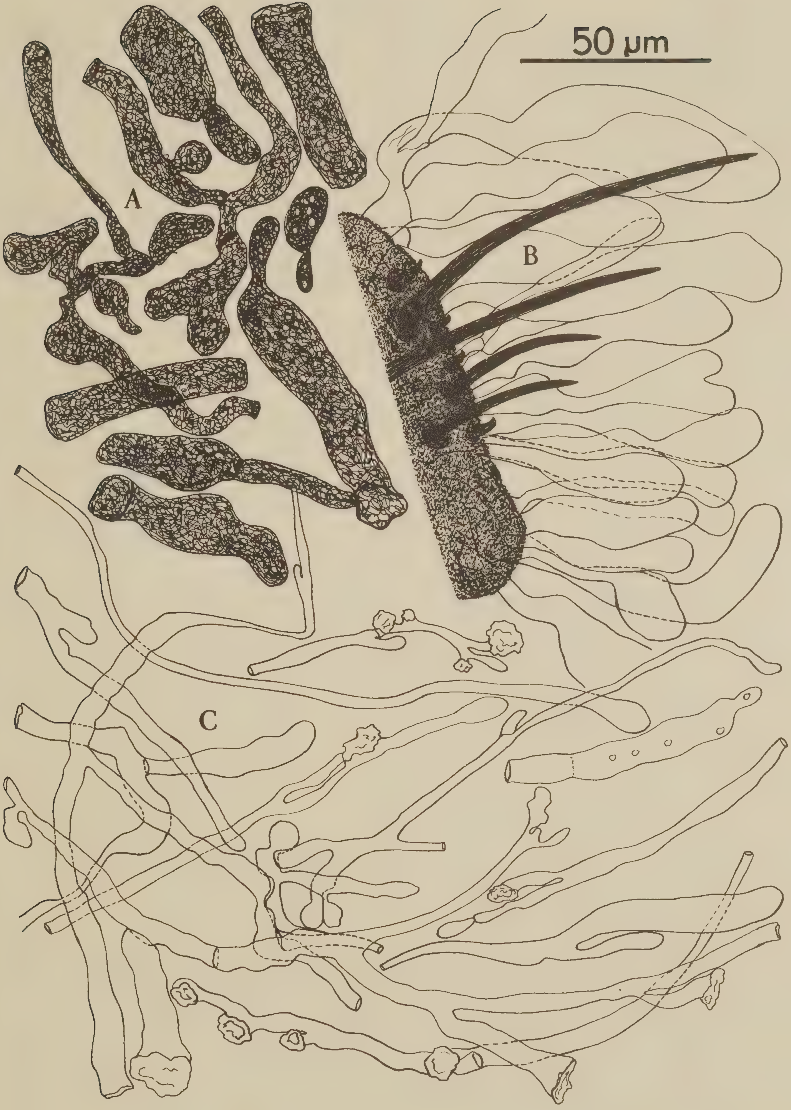
Fig. 5. *Detailed morphology of E. muscae mycelium from the mouthparts of Hylemya brassicae shortly after host's death. A: Hyphal bodies from basal part of rostrum and joint between rostrum and haustellum. B: Outgrowths around labellum. C: Hyphae from labellum with the holdfasts.*


50 µm
A
B
C

REFERENCES

Ainsworth, G.C. (ed.) 1971. Ainsworth & Bisby's Dictionary of the Fungi, 6th ed. Commonw. Mycol. Inst., Kew.

Alexopoulos, C.J., and C. W. Mims. 1979. Introductory Mycology, 3rd ed. John Wiley & Sons, New York.

Batko, A. 1964a. Remarks on the genus *Entomophthora* Fresenius 1856 non Nowakowski 1883 (Phycomycetes: Entomophthoraceae). Bull. Acad. Polon. Sci., Sér. Sci. Biol. 12: 319-321.

Batko, A. 1964b. On the new genera: *Zoophthora* gen. nov., *Triplosporium* (Thaxter) gen. nov. and *Entomophaga* gen. nov. (Phycomycetes: Entomophthoraceae). Bull. Acad. Polon. Sci., Sér. Sci. Biol. 12: 323-326.

Batko, A. 1964c. Remarks on the genus *Lamia* Nowakowski 1883 vs. *Culicicola* Nieuwland 1916 (Phycomycetes: Entomophthoraceae). Bull. Acad. Polon. Sci., Sér. Sci. Biol. 12: 39-402.

Batko, A. 1966. On the subgenera of the fungus genus *Zoophthora* Batko 1964 (Entomophthoraceae). Acta Mycol. 2: 15-21.

Batko, A. 1974. Filogeneza a struktury taksonomiczne Entomophthoraceae. In *Ewolucja biologiczna: szkice teoretyczne i metodologiczne* (C. Nowinski, ed.), p. 209-304. Polska Akad. Nauk, Institut Filozof. Socjol., Wrocław.

Berisford, Y. C., and C. H. Tsao. 1974. Field and laboratory observations of an entomogenous infection of the adult seed corn maggot, *Hylemya platura* (Diptera: Anthomyiidae). J. Georgia Entomol. Soc. 9: 104-110.

Brobyn, P. J., and N. Wilding. 1977. Invasive and developmental processes of *Entomophthora* species infecting aphids. Trans. Brit. Mycol. Soc. 69: 349-366.

Brobyn, P. J., and N. Wilding. 1977. Invasive and developmental processes of *Entomophthora muscae* infecting house-flies (*Musca domestica*). Trans. Brit. Mycol. Soc. 80: 1-8.

Gustafsson, M. 1965. On species of the genus *Entomophthora* Fres. in Sweden. I. Classification and distribution. Lantbrukshögsk. Ann. 31: 103-212.

Hickman, C. J. 1965. Fungal structure and organization. In *The fungi: an advanced treatise* (G. C. Ainsworth and A. S. Sussman, eds.), vol. 1, pp. 21-45. Academic Press, New York.

Humber, R. A. 1981. An alternative view of certain taxonomic criteria used in the Entomophthorales (Zygomycetes). Mycotaxon 13: 191-240.

Karling, J. S. 1932. Studies in the Chytridiales. VII. The organization of the chytrid thallus. Amer. J. Bot. 15: 32-42.

King, D. S., and R. A. Humber. 1981. Identification: Entomophthorales. In *Microbial control of pests and plant diseases* (H. D. Burges, ed.), pp. 107-127. Academic Press, New York.

Lakon, G. 1919. Die Insektenfeinde aus der Familie der Entomophthoreen. Z. angew. Entomol. 5: 161-216.

MacLeod, D. M., and E. Müller-Kögler. 1970. Insect pathogens: species originally described from their resting spores mostly as *Tarichium* species (Entomophthorales: Entomophthoraceae). Mycologia 62: 33-66.

MacLeod, D. M., and E. Müller-Kögler. 1973. Entomogenous fungi: *Entomophthora* species with pear-shaped to almost spherical conidia (Entomophthorales: Entomophthoraceae). Mycologia 65: 823-893.

MacLeod, D. M., E. Müller-Kögler, and N. Wilding. 1976. *Entomophthora* species with *E. muscae*-like conidia. Mycologia 68: 1-29.

Moročkovskii, S. F., M. Ja. Zerova, I. O. Dudka, G. G. Radzievskii, and M. F. Smicka. 1967. Viznačnik gribiv Ukraini. Naukova Dumka, Kiev.

Nowakowski, L. 1883. Entomophthoreae. Przycznek do znajomości pasorzytnych grzybków sprawiających pomór owadów. Pamiętn. Akad. Umiej. w Krakowie 8: 153-183.

Remaudière, G., and S. Keller. 1980. Révision systématique des genres d'Entomophthorales à potentialité entomopathogène. Mycotaxon 11: 323-338.

Snell, W. H., and E. A. Dick. 1957. A glossary of mycology. Harvard University Press, Cambridge, Massachusetts.

Thaxter, R. 1888. The Entomophthoreae of the United States. Mem. Boston Soc. Nat. Hist. 4: 133-201.

Weiser, J. 1966. Nemoci hmyzu. Academia, Prague.

MYCOTAXON

Vol. XIX, p. 408 January-March 1984

NOTICE

MYCOTAXON 20-VOLUME CUMULATIVE INDEX, 1974-1984

A cumulative index to MYCOTAXON covering volumes 1-20 (1974-1984) is currently in preparation by the Managing Editor, Richard P. Korf, and the Index Editor, Susan C. Gruff, planned for publication in late 1984 or early 1985. Complete indices to taxa (and a separate index to new taxa) and to authors (senior and junior authors) will be provided.

The 20-volume index will not be part of the regular subscription to MYCOTAXON, and will need to be bought separately. In order to anticipate the required press run, a **special prepublication price** of $10.00 has been established, provided that payment (or an official purchase order) has been received at the MYCOTAXON office **on or before 1 October 1984.** After that date the regular publication price will be $17.50, postpaid.

Personal subscribers should send their check or money order as soon as practicable. Those individuals associated with a library that subscribes to MYCOTAXON are advised to call this index to the attention of the librarian in time for the library to benefit from the prepublication price. All payments or purchase orders are to be addressed to Mycotaxon, Ltd., P.O. Box 264, Ithaca, NY 14851-0264, USA.

MYCOTAXON

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LATERICONIS, A NEW GENUS OF DEMATIACEOUS HYPHOMYCETES

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During a study on microfungi from Orissa, India, some interesting taxa were collected. One of these grew on rotten bark, and had geniculate conidiophores on which dark, septate, fusiform conidia were inserted laterally. The fungus turned out to represent a hitherto undescribed genus of dematiaceous Hyphomycetes.

Latericonis obscura Vasant Rao, K.A. Reddy & de Hoog, gen. nov., sp. nov.

Coloniae effusae, fuscae vel atro-brunneae. Mycelium plerumque immersum, hyphae superficiales ramosae, septatae, leves, dilute brunneae, 2.0-5.0 µm latae. Conidiophora lateralia ex hyphis oriunda, macronemata, mononemata, solitaria vel fasciculata, erecta, simplicia, geniculata, septata, laevia, pallide vel fusce brunnea, 31-75 µm longa, 3.5-4.0 µm lata ad basim, 4.0-5.0 µm lata ad apicem. Cellulae conidiogenae monoblasticae vel raro polyblasticae, in conidiophoris integrata, primum terminales deinde intercalares, sympodialiter proliferentes, 10-14 µm longae, ad apicem 4.0-5.0 µm latae. Conidia holoblastica, ellipsoidea, fusce brunnea, lenticularia, in medio 2-3 septis obliquis, utrinque 3-4 septis transversalibus divisa, 28-53 x 14-18 µm, cicatrice laterali prominente praedita.
Typus lectus ad corticem arboris cuiusdam (Tectona grandis?), prope Ramagiri in India, positus VMRL sub numero 726, mensis Novembris 1979, a K.A.N.R. et V.R., isotypus depositus IMI 263711, CBS-H 1637.

Colonies effuse, dark to blackish brown. Mycelium mostly immersed, external mycelium composed of branched, septate, FIG-1

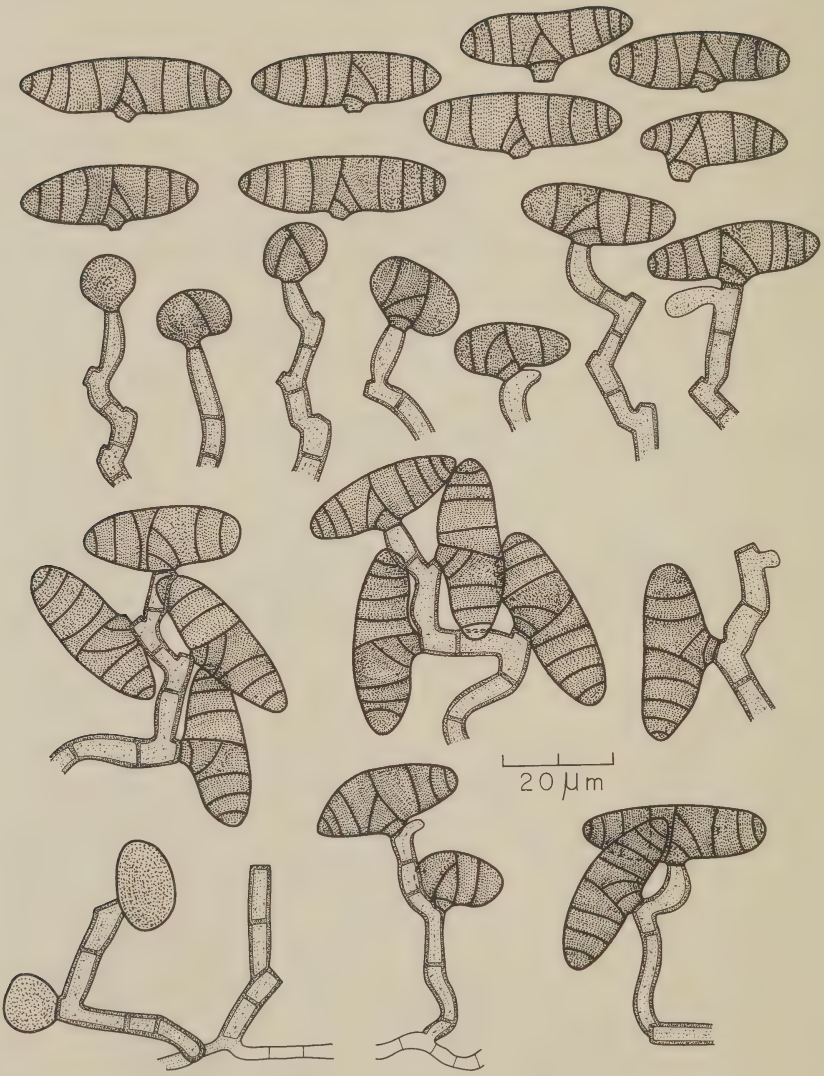

Fig. 1. Latericonis obscura on natural substrate.

smooth, pale brown, 2.0-5.0 µm thick hyphae. Conidiophores macronematous, mononematous, single or in fascicles, erect, simple, geniculate, septate, smooth, pale to dark brown, 31-75 µm long, 3.5-4.0 µm wide at base and 4.0-5.0 µm at apex. Conidiogenous cells monoblastic, rarely polyblastic, integrated, terminal, also becoming intercalary by sympodial elongation, 10.5-14.0 µm long and 4.0-5.0 µm wide at the apex. Conidia holoblastic, with 6-8 transverse and 2-3 oblique septa, medium to dark brown, usually with lighter extremities, fusiform, rounded or slightly pointed at the poles, often slightly constricted at the median septum, 28.0-52.5 x 14.0-17.5 µm, with usually prominent, lateral scar in the middle.
Type specimen: VMRL 726, on unidentified bark (Teak?), Ramagiri, India, Nov. 1979, coll. K.A. Reddy and Vasant Rao; isotypes deposited at CMI and CBS sub IMI 263711 and CBS-H 1637, respectively.

Discussion

At the onset of conidiogenesis, the apex of the conidiophore blows out into a globular structure and a transverse wall is laid down at the base. Subsequently an oblique or eccentric vertical wall develops, dividing the conidial initial into two unequal cells. The next vertical division is also oblique but occurs at an angle to the previous one. This is followed by a third division parallel to the second, resulting in a row of three trapezoid cells. The smallest cell proximal to the conidiophore is transformed into a crucible to cup-shaped basal cell. Subsequent to all these changes, the young conidium elongates at right angles to its longitudinal axis, and the polar primordial cells differentiate, cutting off cells vertically. Because of all these changes, mature conidia are attached laterally to the conidiophore.

The proliferation of the conidiophore occurs immediately below the basal cell of the conidium, and is sometimes at acute angles resulting in a strongly geniculate pattern.

No similar fungi have been listed in Carmichael et al. (1980), neither in Ellis's (1971, 1976) review of dematiaceous Hyphomycetes.

ACKNOWLEDGEMENTS

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LITERATURE CITED

Carmichael, J.W., W.B. Kendrick, I.L. Conners and L. Sigler. 1980. Genera of Hyphomycetes. Univ. Alberta, Alberta.
Ellis, M.B. 1971. Dematiceous Hyphomycetes. Commonwealth Mycological Institute, Kew.
Ellis, M.B. 1976. More Dematiaceous Hyphomycetes. Commonwealth Mycological Institute, Kew.

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THE LICHEN FLORA OF NAVAJO NATIONAL MONUMENT, ARIZONA

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SUMMARY

The lichen flora of Navajo National Monument was examined from 1975 through 1981. Specimens were collected and identified from thirteen separate substrates including: three species of shrubs, five species of trees, decorticated wood, Navajo sandstone cliffs, slickrock and boulders, moss and soil. A total of eighty-five species in thirty genera have been identified during the course of this study.

INTRODUCTION

Navajo National Monument is located in Navajo County in northeastern Arizona and is the site of the remains of three large Anasazi Indian cliff dwellings. The Betatakin Canyon unit of the Monument, the site of the present study, is a side canyon of the larger Tsegi Canyon complex (Hack, 1945) consisting of 180 hectares. The major geological formation of Betatakin Canyon is Navajo Sandstone, which frequently forms cliffs in excess of 200 m in height. The canyon floor consists of deep alluvial deposits of sandy Quarternary fill with Kayenta sandstone outcrops common in the lower parts of the canyon.

A mature pinyon-juniper community occurs on the mesas and slopes above the canyon and extends onto large areas of exposed slickrock along the periphery of the canyon. Pinus edulis and Juniperus osteosperma are the dominant tree species in this community. The understory is dominated by a variety of shrubs including Artemisia tridentata, Cercocarpus intricatus, Cowania mexicana, Purshia tridentata, Fendlera rupicola, and Shepherdia rotundifolia (Brotherson et al. 1978). The unique geological features and moisture relations found at the bottom of Betatakin Canyon combine to support an unusual vascular plant flora which includes species which are typically found at higher elevations such as Populus tremuloides and Pseudotsuga menziesii.

Lichen species were specifically collected from corticolous, terricolous and saxicolous substrates on the mesa and slickrock surrounding Betatakin canyon as well as from those same basic substrates on the floor of the canyon. A total of 547 specimens were collected during the course of this study. All collections are now housed in either the Brigham Young University cryptogamic herbarium or the personal collection of Larry L. St. Clair. The only other effort to characterize the lichen flora of the Monument was undertaken by Seville Flowers in 1963. In this study twenty-one species of saxicolous and terricolous lichens were reported for the Monument (Flowers 1963). Seville Flowers' complete lichen collection is now deposited in the University of Colorado cryptogamic herbarium.

RESULTS

A total of eighty-five species in thirty genera were collected and identified from thirteen different substrates in two major areas in the Monument between 1975 and 1981. Below is an alphabetical listing by genera of the lichen species identified during the course of the study with references to their distribution by substrate.

ACAROSPORA Mass.

Acarospora fuscata (Schrad.) Arn. on Navajo sandstone cliffs and slickrock.

Acarospora strigata (Nyl.) Jatta on Navajo sandstone cliffs and slickrock. This species typically demonstrates heavy prunosity.

ASPICILIA Mass.

(The Aspicilia group is at best a confusing and difficult group, that desperately needs much careful review and attention. Species distinctions are often incomplete and vague, and to further complicate matters there appears to be a wide range of morphotypes which do not appear to fit anywhere. The two species listed in this study have been separated primarily on the basis of spore size and the number of spores per ascus.)

Aspicilia caesiocinerea (Nyl.) Hue on Navajo sandstone cliffs and slickrock.

Aspicilia calcarea (L.) Mudd. on Navajo sandstone cliffs and slickrock, as well as on small pebbles on the soil. (The organism collected commonly on small pebbles, which has a thick, warty, gray-green thallus has been designated *Aspicilia desertorum* yet the spore characteristics are identical to *A. calcarea*).

BACIDIA De Not.

Bacidia umbrina (Ach.) Bausch on Navajo sandstone cliffs and slickrock.

BUELLIA De Not.

Buellia lepidastra (Tuck.) Tuck. on Navajo sandstone cliffs and slickrock.

Buellia punctata (Hoffm.) Mass. on the bark of *Juniperus osteosperma* and *Pseudotsuga menzeisii*.

Buellia retrovertens Tuck. on Navajo sandstone cliffs and slickrock.

Buellia zahlbruckneri J. Stein. on decorticated wood and the bark of *Juniperus osteosperma*.

CALOPLACA Th. Fr.

Caloplaca arizonica Magn. collected from the bark of *Juniperus osteosperma*, *Fendlera rupicola* and *Quercus gambelii*.

Caloplaca cerina (Ehrh.) Th.Fr. on the bark of *Quercus gambelii*.

Caloplaca durietzii Magn. collected from decorticated wood and the bark of *Juniperus osteosperma*.

Caloplaca epithallina Lynge collected as a parasite on other lichen species.

Caloplaca ferruginea (Huds.) Th.Fr. on the bark of *Cowania mexicana*.

Caloplaca flavovirescens (Wulf.) Dalla Torre and Sarnth. on Navajo sandstone cliffs and slickrock.

Caloplaca holocarpa (Hoffm.) Wade collected from the bark of *Quercus gambelii*, *Fendlera rupicola*, *Juniperus osteosperma* and *Populus tremuloides*.

Caloplaca jungermanniae (Vahl) Th.Fr. collected as an epiphyte on moss species overgrowing Navajo sandstone.

Caloplaca microphyllina (Tuck.) Hasse Common on decorticated wood and the bark of *Juniperus osteosperma*.

Caloplaca pinicola Magn. collected from the bark of *Juniperus osteosperma*.

Caloplaca trachyphylla (Tuck.) Zahlbr. common on Navajo sandstone cliffs and slickrock.

CANDELARIELLA Mull. Arg.

Candelariella deflexa (Nyl.) Zahlbr. on the bark of *Populus tremuloides*.

Candelariella rosulans (Mull. Arg.) Zahlbr. collected from Navajo sandstone cliffs and slickrock.

Candelariella vitellina (Ehrh.) Mull. Arg. on Navajo sandstone cliffs and slickrock.

CLADONIA Wigg.

Cladonia pyxidata (L.) Hoffm. collected from the soil at the bottom of Betatakin canyon.

COLLEMA Wigg.

Collema polycarpon Hoffm. on Navajo sandstone cliffs and slickrock.

Collema tenax (Sw.) Ach. collected commonly from the soil. (This species is one of the most common terricolous lichens of the aridland cryptogamic soil crust community.)

DERMATOCARPON Eschw.

Dermatocarpon lachneum (Ach.) A.L. Sm. common on soil.

Dermatocarpon miniatum (L.) Mann collected from seep areas and crevices on Navajo sandstone cliffs.

Dermatocarpon plumbeum (B. de Lesd.) Zahlbr. on Navajo sandstone cliffs.

DIPLOSCHISTES Norm.

Diploschistes actinostomus (Pers.) Zahlbr. collected from the soil and also from Navajo sandstone cliffs.

Diploschistes scruposus (Schreb.) Norm. on Navajo sandstone cliffs and on soil overlying sandstone.

ENDOCARPON Hedw.

Endocarpon wilmsoides Zahlbr. collected from Navajo sandstone cliffs and slickrock. Thompson has suggested that this may be a *Staurothele* rather than an *Endocarpon*.

FULGENSIA Mass. and De Not.

Fulgensia fulgens (Sw.) Elenk. on soil.

HETERODERMIA Trev.

Heterodermia speciosa (Wulf.) Trev. collected from the bark of *Pseudotsuga menzeisii*.

LASALLIA Mer.

Lasallia papulosa (Ach.) Llano collected from Navajo sandstone cliffs.

LECANORA Ach.

Lecanora badia (Hoffm.) Ach. on Navajo sandstone cliffs.

Lecanora chlarotera Nyl. collected from the bark of *Quercus gambelii* and *Pseudotsuga menzeisii*.

Lecanora chloropolia (Erichs.) Almb. on the bark of *Quercus gambelii*.

Lecanora christoi W. Web. occurs on Navajo sandstone cliffs and slickrock.

Lecanora chrysoleuca (Sm.) Ach. collected from Navajo sandstone cliffs and boulders.

Lecanora crenulata (Dicks.) Nyl. on Navajo sandstone cliffs and slickrock.

Lecanora dispersa (Pers.) Somm. collected from Navajo sandstone cliffs and slickrock.

Lecanora frustulosa (Dicks.) Ach. on Navajo sandstone slickrock. *Lecanora hageni* (Ach.) Ach. on the bark of *Juniperus osteosperma* and *Pseudotsuga menzeisii*.

Lecanora melanophthalma (Ram.) Ram. on Navajo sandstone cliffs and boulders.

Lecanora muralis (Schreb.) Rabenh. common on Navajo sandstone cliffs, slickrock and boulders.

Lecanora novomexicana Magn. collected from Navajo sandstone cliffs and slickrock.

Lecanora piniperda Korb. on the bark of *Cercocarpus intricatus*.

Lecanora saligna (Schrad.) Zahlbr. collected from the bark of *Cercocarpus intricatus*.

LECIDEA Ach.

Lecidea auriculata Th.Fr. collected on small rocks from the soil surface and from Navajo sandstone cliffs and slickrock. Thallus scant to absent.

Lecidea cerebriformis (W. Web.) *in ed*

Lecidea decipiens (Hedw.) Ach. collected commonly from the soil.

Lecidea novomexicana (B. de Lesd.) W. Web. collected on soil.

Lecidea russellii Tuck. on soil.

Lecidea tessellata (Ach.) Florke common on Navajo sandstone cliffs and slickrock. Thallus well developed or more often scant to absent.

LECIDELLA Korb

Lecidella euphorea (Flk.) Hertel collected from the bark of *Juniperus osteosperma*, *Quercus gambelii* and *Pseudotsuga menzeisii*.

Lecidella stigmatea (Ach.) Hert. and Leuck. on Navajo sandstone cliffs and slickrock.

Lecidella viridans (Flot.) Korb. collected from Navajo sandstone cliffs and slickrock.

LEPRARIA Ach.

Lepraria membranacea (Dicks.) Vain. collected from heavily shaded sections of Navajo sandstone cliffs and boulders.

PARMELIA Ach.

Parmelia elegantula (Zahlbr.) Szat. collected from the bark of *Quercus gambelii*. This particular species typically demonstrates a lightly pruniose thallus.

Parmelia lineola Berry collected from Navajo sandstone boulders. TLC. analysis conducted by Chicita Culberson and Anita Johnson.

Parmelia mexicana Gyeln. collected commonly from Navajo sandstone cliff faces. TLC. analysis conducted by Chicita Culberson and Anita Johnson.

Parmelia plittii Gyeln. collected from Navajo sandstone boulders. TLC. analysis conducted by Chicita Culberson and Anita Johnson.

Parmelia subolivacea Nyl. this species was collected commonly from several corticolous substrates including: *Cowania mexicana*, *Pinus edulis*, *Quercus gambelii* and *Cercocarpus intricatus*.

PELTIGERA Willd.

Peltigera canina var. *canina* (L.) Willd. common on the soil in the more mesic parts of the canyon as well as beneath shrubs in the slickrock area. Rhizines simple or fibrillose, upper surface of thallus dull; veins distinct.

PERTUSARIA DC.

Pertusaria saximontana Wetm. this species was collected from decorticated wood.

PHYSCIA (Schreb.) DC.

Physcia aipolia (Ehrh.) Hampe collected commonly from the bark of *Quercus gambelii*.

Physcia biziana (Mass.) Zahlbr. on the bark of *Quercus gambelii* and *Juniperus osteosperma*.

Physcia ciliata (Hoffm.) Du Rietz collected from the bark of *Juniperus osteosperma*.

Physcia dubia (Hoffm.) Lett. on the bark of *Pseudotsuga menzeisii*.

Physcia stellaris (L.) Nyl. from the bark of *Cowania mexicana*, *Pinus edulis* and *Quercus gambelii*.

PHYSCONIA Poelt

Physconia grisea (Lam.) Poelt collected from the bark of *Fendlera rupicola* and on moss.

Physconia pulverulenta (Schreb.) Poelt on the bark of *Pseudotsuga menziesii*.

RINODINA (Ach.) S. Gray

Rinodina archaea (Ach.) Arn. from the bark of *Juniperus osteosperma*.

Rinodina exigua (Ach.) S. Gray collected from the bark of *Juniperus osteosperma*.

Rinodina pyrina (Ach.) Arn. from the bark of *Pseudotsuga menzeisii*.

SARCOGYNE Flot.

Sarcogyne clavus (Ram.) Kremp. on Navajo sandstone cliffs and slickrock.

SQUAMARINA Poelt

Squamarina lentigera (G. Web.) Poelt collected from soil.

STAUROTHELE Norm.

Staurothele clopima (Wahlenb. *ex* Ach.) Th.Fr. common on Navajo sandstone cliffs and slickrock.

TONINIA Th.Fr.

Toninia caeruleonigricans (Lightf.) Th.Fr. common on soil.

Toninia tristis (Th.Fr.) Th.Fr. collected from soil.

USNEA P. Br. *ex* Adans.

Usnea hirta (L.) Wigg. collected from the bark of *Pinus edulis* and *Pseudotsuga menzeisii*.

XANTHORIA (Fr.) Th. Fr.

Xanthoria elegans (Link) Th.Fr. collected commonly from Navajo sandstone cliffs and slickrock.

Xanthoria fallax (Hepp) Arn. common on the bark of *Quercus gambelii* and *Fendlera rupicola*.

Xanthoria polycarpa (Ehrh.) Oliv. common on the bark of *Quercus gambelii*, *Fendlera rupicola* and *Cercocarpus intricatus*.

DISCUSSION

Among the various substrates examined during the course of this study Navajo Sandstone cliffs slickrock and boulders supported the most diverse lichen flora, with a total of 38 species. This number includes 34 species which occur exclusively on Navajo sandstone substrates. A total of 33 species were collected from the combined corticolous substrates, 32 of which occurred exclusively on either bark or decorticated wood. *Quercus gambelii* and *Juniperus osteosperma* exhibited the most diverse floras with 13 species each and three and four species respectively which were limited to those specific substrates. Several of the corticolous species showed little or no specific substrate preference and were consequently collected from several different trees and shrubs. Included in this group were: *Caloplaca holocarpa* and *Parmelia subolivacea* which were collected from the bark of 4 different trees and shrubs, and *Caloplaca arizonica*, *Lecidella euphorea*, *Physcia stellaris* and *Xanthoria polycarpa*, each of which were collected from three different trees and shrubs. Fourteen terricolous lichens were collected with 12 of the 14 species occurring exclusively on the soil. In addition to these major substrates there were two species which were collected as epiphytes growing over bryophytes and one species which occurred as a parasite on other lichens. There were also two species which were commonly found on small stones on the soil surface.

BIBLIOGRAPHY

Brotherson, J. D., G. Nebeker, M. Skougard and J. Fairchild. 1978. Plants of Navajo National Monument. Great Basin Naturalist 38(1):19-30.

Flowers, S. 1963. The lichen and moss flora of Betatakin Canyon and vicinity Navajo National Monument, Arizona. University of Utah Division of Biological Sciences, Misc. Papers Number 3.

Hack, J. T. 1945. Recent geology of the Tsegi Canyon. Appendix I, in R. L. Beals, G. W. Brainerd and W. Smith, Archeological Studies in Northeast Arizona. University of California Press, Berkeley and Los Angeles.

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PEZIZA PILEOCROCATA CROUAN & CROUAN, A SYNONYM OF ARACHNOPEZIZA AURELIA (PERS. : FR.) FUCKEL

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When I wrote my monograph of the Arachnopezizeae (Korf, 1952), there were a number of imperfectly known species for which types were either unknown or unavailable. One of these was Peziza pileocrocata Crouan & Crouan (1867), which Boudier (1907) had transferred to Arachnopeziza. I reported at that time the information relayed to me by Mme. Marcelle Le Gal that the specimens in the Crouan brothers' herbarium were both unarranged and uncatalogued, so that it was impossible to determine whether the type specimen still existed, and that under terms of the will, the specimens could not be sent from Quimper, in the province of Finistère.

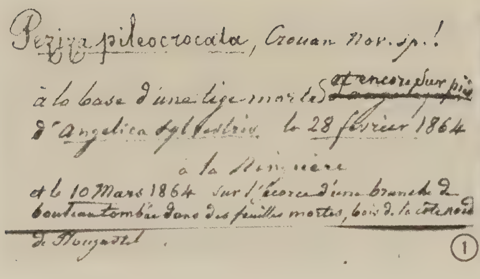
This past summer I was able at long last to visit the Crouan brothers' herbarium, now housed at the Laboratoire de Biologie Marine du Collège de France, at Concarneau. Dr. Yves Le Gal serves as curator of the collection (CO), and I acknowledge here his valued assistance as well as financial support from Cornell's Plant Pathology Department.

The fungi, lichens, and algae are to be found at Concarneau in the library, mostly in drawers or in assorted boxes stored beneath the books. Most, if not all of the phanerogamic collections are apparently still in the city of Quimper. Some organization of the fungi was attempted by Mme. Le Gal when she revised some of the Crouan specimens of Discomycetes (Le Gal, 1953, 1960); only two parts of her studies were ever published. Since that time Dr. J. A. van Brummelen of the Rijksherbarium, Leiden, has annotated a number of the specimens, particularly of Ascobolus and of Saccobolus.

The original description of Peziza pileocrocata indicated that the species was known from two substrata on two dates:

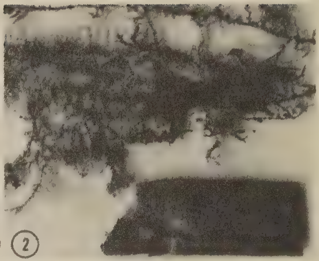
"**P[eziza] pileocrocata** Crn. mscr. – Réceptacle, fixé sur un mycelium aranéeux blanc, de 1 à 2 centim., hémisphérique, à bord ondulé, couvert de poils fasciculés d'un jaune safrané, hymenium blanchâtre, thèques claviformes à 8 spores oblongues, paraphyses capillaires plus longues que les thèques. – Sur l'écorce d'un ramule mort et tombé de Bouleau et sur la base d'une tige mort d'Angélique. Pr. r. r."

My search through the various envelopes enclosing packets and assorted illustrations devoted to Discomycetes in a few drawers of the library resulted in the discovery of a single packet (Fig. 1) with data that matches rather well the two original substrata in the printed diagnosis. Within the packet are two easily distinguishable parts (Fig. 2), one a piece of bark from a woody host, the other a mass of mosses and debris presumably from the forest floor. Both parts bear apothecia and the subiculum of the same species of Arachnopeziza.



Peziza pileocrocata, Crouan nov. sp.!
à la base d'une tige morte ~~[illegible]~~ et encore sur pié
d'Angelica sylvestris le 28 février 1864
à la [illegible]
et le 10 Mars 1864 sur l'écorce d'une branche de
bouleau tombée dans des feuilles mortes, bois de la côte nord
de Plougastel.

①



②

Fig. 1. Packet containing syntypes of Peziza pileocrocata. Fig. 2. Lectotype (above) and lectoparatype (below), X 1. Photographs by author.

I hereby designate the collection of 28. fév. 1864 the LECTOTYPE specimen, and am prepared to state that this collection is that represented by the material with mosses and with the more mature apothecia, shown in the upper portion of Fig. 2. The other collection, that of 10 mars 1864, on bark of Bouleau (= Betula), now constitues the LECTOPARATYPE from what was previously a pair of syntypes, and is the piece of wood and bark in that packet.

The Crouans had originally described their species as having "Réceptacle ... de 1 à 2 centim., ..." - a dimension that would have made it by far the largest Arachnopeziza known. This led me to placing it among the doubtful species. There was, however, merely an error in recording the size, which is clearly 1 to 2 millimeters in diameter. Without hesitation I am able to place this name in synonymy with the older Peziza aurelia Pers. : Fr. The names and citations for Peziza pileocrocata Cr. & Cr., Lachnea pileocrocata (Cr. & Cr.) Gill., Tapesia pileocrocata (Cr. & Cr.) Sacc., Eriopezia crocata (Cr. & Cr.) Sacc. & Sacc. in Sacc., and Arachnopeziza crocata (Cr. & Cr.) Boud. (Korf, **1952**: p. 170) thus all should be transferred to the synonymy of Arachnopeziza aurelia (Pers. : Fr.) Fuckel. Two other corrections should be noted. First, I recorded as a synonym of this species (Korf, **1952**: p. 160) the name "Polynema aurelium (Pers. ex Fr.) Fckl.," the spelling used when it was originally published by Fuckel. The correct citation should be Polynema aurelia (Pers. : Fr.) Fckl., since the epithet is a noun and does not decline. Second, the combination Arachnoscypha aurelia on the same page was actually made three years earlier than that cited, by the same author, and should be given as Arachnoscypha aurelia (Pers. : Fr.) Boud., Icon. mycol. Liste Préliminaire, p. [4], 1904 (the combination attributed to Fuckel).

LITERATURE CITED

CROUAN, P. L., & H. CROUAN. **1867**. Florule de Finistère. 262 pp.

KORF, RICHARD P. **1952**. A monograph of the Arachnopezizeae. Lloydia **14**: 129-180. '1951.'

LE GAL, M. **1953**. Les discomycètes de l'herbier Crouan. Rev. Mycol. (Paris) **18**: 73-132.

LE GAL, M. **1960**. Les discomycètes de l'herbier Crouan. Deuxième série. Ann. Sci. Nat. Bot., sér. 12, **1**: 441-467.

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SOME FUNGI OF *CERCOSPORA* COMPLEX FROM BURMA

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SUMMARY

Specimens of *Cercospora* complex from 68 supportive families in Burma on deposit in Herbaria LAM and IMI are examined, identified and enumerated to generate an annotated country list of some 200 taxa including those reported in literature. Generic and species concepts regarding this complex are discussed in the light of modern hyphomycete systematics. The need for a critical re-evaluation of these concepts preferably through a computer technique is also stressed.

INTRODUCTION

This is one of the contributions to the taxonomic and morphologic knowledge of the fungi from Burma.

The largest genus collected to date from Burma is *Cercospora* Fres. in its broad and complex sense. It comprises over 200 taxa from both known and unknown hosts in Burma. Specimens from the hosts are identified, wherever possible, to species. No attempts have, however, been made to name new species simply and solely on host basis. A brief description is provided of the morphology of the fungi from hosts on which they have, as far as ascertainable, been unrecorded or unreported.

Since the establishment of the genus *Cercospora* by Fresenius in 1863, some 2000 fungi have been classified as species of *Cercospora* (Ellis, 1971, 1976), but in recent years, this generic entity as accepted in the past by Chupp (1954), Penzes (1927) and Solheim (1930) has been recognized to be heterogeneous in character. Revision of generic concepts within these fungi by Deighton (1959, 1967, 1969, 1971, 1973, 1974, 1976, 1979) has resulted in an array of segregate genera: i.e. *Elletevera*, *Eriocercospora*, *Paracercospora*, *Pseudocercosporella*, *Pseudocercosporidium* and *Stenospora* for disposition of a number of taxa out of *Cercospora*. A summary of characters by which these segregate genera may be distinguished among themselves, and from *Cercospora* and other similar genera, is provided in Table I.

The segregate genera proposed by Deighton are difficult to recognize and are therefore included among those listed by Carmichael et al. (1980) as tentative synonyms of *Cercospora*. A similar view is also expressed by Sutton (pers. comm.) for some of these genera. Kendrick (pers. comm.) also is "suspicious concerning the usefulness of the clutch of genera fragmented from it."

Segregation of these genera from *Cercospora* is based primarily on the habit of the fungus or on a single secondary character such as the thickening/type of thickening or the unthickening of conidial scar on the conidiogenous cell of the fungus. For example, *Cercosporella* Saccardo is the genus for *Cercospora* species with protuberant scars (about 1.5-2 µm thick) and *Pseudocercosporella* Deighton for *Cercospora* species with inconspicuous scars. *Eriocercospora* Deighton is the taxon for *Cercospora* species with unthickened scars and hyperparasitic habit. The term "unthickened scar" means the scar and the wall of the conidiogenous cell are of the same thickness (Deighton, 1976). The characters emphasized by Deighton to segregate the genera from *Cercospora* are minor or secondary, and do not accurately reflect generic concepts and delimitation as they are currently accepted in the hyphomycetes (Carmichael et al., 1980; Kendrick, 1980; Kendrick and Carmichael, 1973; Pollack, 1971; Sutton, pers. comm.).

Even the character sets required by such concepts are not sufficient by themselves for generic delimitations among some fungicolous hyphomycetes and their relatives (De Hoog, 1978). Truly significant morphological characters such as those with indicative or predictive value, e.g., septal pore (Kendrick, 1980) or position of the hilum as in *Helminthosporium* (Luttrell, 1978) are also utilized as additional characters for generic separation in hyphomycetes. Hence, Deighton's generic concepts in the *Cercospora* complex are in need of critical re-examination.

In his recent appraisal of generic concepts in hyphomycetes, Kendrick (1980) strongly and convincingly made a case for re-examination of genera with virtually indistinguishable morphology for their maintenance or discontinuance as separate taxa, and for utilization of well-defined characters in adequate number for delimitation of genera. It is evident that there is a need for re-evaluation of the relationships among *Cercospora* and segregate genera, and for new rationalization and recircumscription of genera in this group.

By numerous successful cross-inoculation experiments, Johnson and Valleau (1949) repeatedly demonstrated the wide

TABLE I

Differences Between *Cercospora* and Allied Genera

Genus	Mycelium		Stroma		Conidia		Conidial scar		Habit		Remarks
	Internal	External	Present	Absent	Smooth	Rugulose	Thickened	Unthickened	Plant Parasitic	Hyperpara- sitic	
Cercospora	+	+	+	+	+	−	+	+	+	−	
Cercoseptoria	+	−	+	−	+	−	−	+	+	−	Acicular
Cercosporella	+	+	+	+	+	−	+'	−	+	−	'Extensive
Cercosporidium	+	−	+	−	+	+	+	−	+	−	
Elletevera	+	−	−	+	+	−	+	−	−	+	
Eriocercospora	−	+	−	+	+	−	−	+	−	+	
Paracercospora	+	−	+	+	+	−	+°	−	+	−	°Rim
Passalora	+	−	−	+	+	−	+	−	+	−	
Phaeoisariopsis	+	−	+	−	+	+	+	−	+	−	
Pseudocercospora	+	+	+	+	+	+	−	+	+	−	
Pseudocercosporella	+	−	+	+	+	−	−	+	+	−	
Pseudocercosporidium	+	−	−	+	+	−	+'	−	+	−	'Extensive
Stenospora	−	+	−	+	+	−	−	+	−	+	

+	Yes
−	No

host-range of *Cercospora* species. Despite this evidence, these species continue to be usually named merely on a host-parasite basis. Therefore, it is almost impossible to identify a specimen of *Cercospora* from a host or from a culture correctly without knowledge of the identity of the host. Frequently, *Cercospora* species on the same host plant are further differentiated chiefly on the basis of variations in size and shape of conidia and conidiophores in spite of the observations by Butler (1918) and Wells (1925) that these morphological characters are inconsistent and subject to change in environment. For example, Yen and Lim (1980) thus described 72 new taxa out of 98 species they reported for the Malay Peninsula and Singapore. Such practice has led to proliferation of *Cercospora* species up to some 2000 at present. The classification of *Cercospora* species thus suffers from continued use of host and variable morphological characters.

Ellis (1976) suggested the use of conidial color for separating the species into hyaline-spored and nonhyaline-spored groups. Accordingly, he mentioned spore color, and disregarded spore shape, in his description of 107 species of *Cercospora*. His concept is not tenable in view of mixtures of shades of conidial colors in *Cercospora*.

Such separation of new genera and new species as heretofore discussed is neither realistic nor really very satisfactory.

It is apparent that a technique which utilizes as many characters as possible to interpret species of *Cercospora* through a quantitative measure of similarity will be the most logically satisfactory. Ainsworth (1962) first suggested a computer analysis for the genus *Cercospora*. Ibrahim and Elamin (1974) made such an analysis of 30 *Cercospora* species from Sudan, utilizing a single-linkage cluster method. The method was previously applied successfully by Ibrahim and Threlfall (1966) and Kendrick and Proctor (1964) to hyphomycetes. The computer methods using UPGMA cluster analysis and principal coordinate analysis, and the NTSYS computer programs and the PCFLOR principal components analysis program have been recently applied respectively by Mueller (1981) and Wolfe (1981) to higher basidiomycetes. These latter methods are more reflective of the relationships among taxa and thus give the best and accurate results (Sneath, 1966). A computer technique is also of value in monographic studies since it provides good tests for taxonomic schemes based on orthodox approach (Hawksworth, 1974).

Direct study of collections of specimens developed in nature should be the method of choice to generate data for computer analysis. Pure culture methods are not advisable in view of the fact that *Cercospora* and similar species are mostly sterile in pure culture or most of these species in pure culture develop only a dark slowly growing mycelium and no conidia (Arx, 1974; Vasudeva, 1963). Moreover, some generic segregates, e.g. *Elletevera, Eriocercospora* and *Stenospora* are hyperparasites and cannot be cultivated in pure culture. Furthermore, it has never been obligatory in the genus *Cercospora* and allied genera to grow the organisms in artificial culture for purpose of identification because the morphology of these taxa is usually well developed in nature, and is by itself complete for taxonomic analysis without the need for intervention of pure culture work. Besides, collections of *Cercospora* and segregate genera direct from their hosts provide adequate natural history specimens and more original biometric data for computer analysis.

Cross-inoculation experiments will be inappropriate, since the problem under focus is a fungal taxonomic problem independent of the host, i.e. the fungal taxon should be based primarily on morphology (Chesters, 1969).

PRESENTATION

The arrangement by host families and reference to some taxa by Deighton's new combination or new names are made in the following country list just to reflect the recent trend in the taxonomy of *Cercospora*. Such presentation does not, however, imply or signify the acceptance or endorsement thereof. No new names are given pending resolution of problems associated with the systematics of *Cercospora* complex.

ACANTHACEAE

Cercospora acanthi Pass. on leaves of an acanthaceous herb, causing minute purplish spots with brownish margins on both sides; Mandalay, 2-II-1973 (IMI 172881), 2-X-1979 (LAM 220683).

C. peristrophes Thirum. & Govindu on leaves of *Peristrophe bicalyculata* Nees; Mandalay, 31-I-1974 (IMI 182561).

Pseudocercospora rhinacanthi (Hohnel) Deighton on leaves of *Rhinacanthus communis* Nees; Rangoon, 30-IX-1979 (LAM 220583).

ADIANTACEAE

Cercospora asplenii Jaap on leaves of *Adiantum* species; Rangoon, 19-IX-1974 (IMI 188959), 12-X-1979 (LAM 220605).

ALLIACEAE

Cercospora duddiae Welles on leaves of *Allium sativum* L., causing chlorotic spots with grey to brown centers; Mandalay, 4-III-1974 (IMI 183216).

AMARANTHACEAE

Cercospora achyranthina Thirum. & Chupp on leaves of *Achyranthes aspera* L.; Mandalay, 27-X-1971 (IMI 161581); Rangoon, 20-VII-1979 (LAM 220519).

C. celosiae Syd. on leaves of *Celosia argentea* L.; Yezin, 15-IX-1977 (LAM 220210).

AMARYLLIDACEAE

Cercospora pancratii Ell. & Ev. on leaves of *Crinum amabile* Don and *Hymenocallis littoralis* (Jacq.) Salisb.; Rangoon, 18-X-1979 (LAM 220602, 220603).

Note: A *Mycosphaerella* species with ascospores measuring about 9 x 3 µm is found as one of its consociates. Another *Mycosphaerella* species found independently on leaves of *Crinum amoenum* from Maymyo (Botanical Garden) on 20-V-1975 (IMI 194462) differs from *M. crini* Siemaszko in larger sized ascospores.

APOCYANACEAE

Cercospora canescens Ell. & Mart. on leaves of *Rauwolfia serpentina* Benth. & Kunze; Mandalay, 10-V-1975 (IMI 194465a).

C. plumeriae Chupp on leaves of *Plumeria acutifolia* Poiret; Rangoon, 29-IX-1979 (LAM 220588).

Note: A *Mycosphaerella* species is found as one of its consociates.

Pseudocercospora liebenbergii (Syd.) Deighton on leaves of *Rauwolfia serpentina* Benth. & Kunze; Taikkyi Farm, 25-X-1979 (LAM 220628).

Note: *Mycosphaerella rauwolfiae* T. S. & K. Ramakrishnan is found as one of its consociates. An immature *Mycosphaerella* (LAM 220091) has also been recorded on this host plant species in Mandalay.

P. neriella (Sacc.) Deighton on leaves of *Nerium indicum* Mill. and *N. odorum* Soland; Mandalay, 10-IX-1972 (IMI 170083), 12-XII-1977 (LAM 220441), Rhind & Seth (1945).

Note: Conidia obclavoto-cylindric, multiseptate, 34-80 x 3-4(-5) µm.

P. tabernaemontanae (H. & P. Syd.) Deighton on leaves of *Tabernaemontana coronaria* R. Br.; Rangoon, 3-VIII-1972 (IMI 169347), 18-II-1978 (LAM 220366).

Note: Stromata dark brown, 60-80 x 32-44 µm; conidiophores pale, 10-16 x 3 µm; conidia cylindro-obclavate, subhyaline, 2-5 septate, 36-72 x 2-4 μm.

ARACEAE

Cercospora alocasiae Sawada on leaves of *Arum* lilly; Maymyo (Botanical Garden), 10-XII-1974 (IMI 190425), Aungban, 27-XII-1979 (LAM 220808a).

Cercospora species on leaves of *Raphidophora merrillii* Engl.; Rangoon, 28-IX-1979 (LAM 220584).

Pseudocercospora colocasiae Deighton on leaves of *Colocasia esculentus* (L.) Schott; Rangoon, 8-XI-1973 (IMI 180776).

Note: Stromata none; conidiophores loosely fasciculate, medium dark olivaceous, 170-293.75 x 5 μm; conidia pale olivaceous, clavate, usually 3-septate, 22.5-26.25 x 11.25-12.5 μm.

ASCLEPIADACEAE

Cercospora calotropidis Ell. & Ev. on leaves of *Calotropis gigantea* (Willd.) R. Br.; Mandalay, 7-XII-1971 (IMI 163204); Rangoon, 22-XII-1979 (LAM 220804), Rhind & Seth (1945).

Cercospora species on leaves of *Oxystelma esculentum* R. Br., causing small greyish spots; Rangoon (Bazaar), 18-XI-1979 (LAM 220695).

Note: Stromata small; conidiophores divergent, straight, flexuous, uniform in width, brown, septate, geniculate towards the apex, 148-203.5 x 5.5 μm; conidia hyaline, acicular, multiseptate, up to 259 μm long, 4.5-5.5 μm wide, with a dark hilum at the truncate base.

Pseudocercospora daemiae (Kar & Mandal) Deighton on leaves of *Pergularia minor* Andr.; Rangoon, 7-XII-1976 (LAM 220053).

P. marsdeniae (Hansf.) Deighton on leaves of *Marsdenia volubilis* T. Cooke; Mandalay, 7-XII-1971 (IMI 163023); Meiktila, 7-IX-1974 (LAM 220053).

ASTERINACEAE

Eriocercospora balladynae (Hansf.) Deighton on colonies of *Clypeolella camelliae* (Syd. & Butl.) Hansf. on leaves of *Camellia thea* Link; Kutkhine, 5-IV-1971 (IMI 157832b).

BALSAMINACEAE

Cercospora fukushiana (Matsumura) Yamamoto on leaves of *Impatiens balsamina* L.; Rangoon, 12-IX-1977 (LAM 220208), 23-IX-1979 (LAM 220617).

C. nojimai Togashi & Katsuki on leaves of *Impatiens balsamina* L.; Thazi, 25-XI-1973 (IMI 180784a).

BIGNONIACEAE

Cercospora oroxyli Kar & Mandal on leaves of *Oroxylum indicum* Vent; Nyaunglebin, 28-XII-1972 (IMI 172872); Pyinmana, 12-I-1978 (LAM 220364).

Cercospora species on leaves of *Jacaranda mimosaefolia* D. Don; Rangoon, 10-XII-1979 (LAM 220723).

Note: Conidiophores short; conidia pale, linear to narrowly obclavate, obconico-truncate at base and obtuse at apex, 1-3 or more septate, 40.5-55.5 x 2.5-3 µm, straight or curved.

Pseudocercosporella species on leaves of *Markhamia stipulata* (Wall.) Seem.; Kyaukpadaung, 4-I-1974 (IMI 184228a); Pauk, 12-XII-1978 (LAM 220717).

BOMBACEAE

Cercospora bombacina T. S. & K. Ramakrishnan on leaves of *Bombax malabaricum* DC; Nyaungbinzauk (Myitnge), 21-VI-1972 (IMI 167196).

Note: Leafspots are atypical and the conidia are somewhat narrower than the type and less commonly curved.

C. ceibae Chupp & Viegas on leaves of *Ceiba pentandra* Gaertn. f.; Mandalay, 21-I-1973 (IMI 172870).

CARICACEAE

Cercospora papayae Hansf. on leaves of *Carica papaya* L.; Mandalay, 20-III-1975 (IMI 193706); Belukyun, 12-I-1978 (LAM 220363).

Note: *Mycosphaerella caricae* Syd. is also found on leaves of *Carica papaya* L.; Lashio, 1-II-1975 (IMI 192811b).

COMBRETACEAE

Cercospora catappae P. Henn. on leaves of *Terminalia catappa* L. and *T. chebula* Retz.; Henzada 6-XII-1977 (LAM 220462); Rangoon, 5-XII-1979 (LAM 220701).

Note: A *Mycosphaerella* species (LAM 220776) has been recorded on this host plant species from Rangoon.

COMPOSITAE

Cercospora bidentis Tharp on leaves of *Bidens laevis* (L.) B.S.P., *Bidens* sp., *Coreopsis drummondii* Torr & Gray, *C. lanceolata* L., *Cosmos bipinnatus* Cav.; Mandalay, 23-XI-

1973 (IMI 180759); Rangoon, 6-II-1974 (IMI 182562); Insein, 29-IX-1979 (LAM 220596); Rangoon, 6-XI-1979 (LAM 220684), 5-XII-1979 (LAM 220703); Aungban, 27-XII-1979 (LAM 220791).

C. *blumeae-balsamiferae* Sawada on leaves of *Blumea balsamifera* DC; Rangoon, 23-IX-1979 (LAM 220616).

C. *calendulae* Sacc. on leaves of *Calendula officinalis* L.; Rangoon, 12-XII-1971 (IMI 175735), 27-X-1979 (LAM 220623).

C. *carthami* Sundararam & Ramakrishnan on leaves of *Carthamus tinctorius* L.; Mabet village (Minbu), 18-III-1973 (IMI 174123).

C. *centaureae* Diedicke on leaves of *Centaurea cyanus* L.; Rangoon, 6-II-1980 (LAM 220798).

C. *chrysanthemi* Heald & Wolf on leaves of *Chrysanthemum sinense* Sabine; Mandalay, 23-X-1973 (IMI 180188a).

Cercospora species on leaves of *Cosmos sulphureus* Cav.; Rangoon, 18-X-1979 (LAM 220620).

C. *eupatorii-formosani* Sawada on leaves of *Eupatorium odoratum* L.; Mandalay, 27-X-1971 (IMI 161582); Kyauktaga, 15-XII-1977 (LAM 220352); on leaves of *Ageratum* species; Rangoon, 16-X-1979 (LAM 220606).

C. *gerberae* Chupp & Viegas on leaves of *Gerbera jamesonii* Bolus; Rangoon, 26-I-1975 (IMI 197641); Aungban, 27-XII-1979 (LAM 220899).

C. *grandissima* Rangel on leaves of *Dahlia* species; Rangoon, 5-XII-1979 (LAM 220725).

C. *guizotiae* Siemaszko on leaves of *Guizotia abyssinica* Cass.; Mandalay, 7-XII-1971 (IMI 163007).

C. *longissima* Cugini ex Trav. on leaves of *Lactuca sativa* L.; Aungban, 27-XII-1979 (LAM 220796).

C. *tridacis-procumbentis* Govindu & Thirum. on leaves of *Tridax procumbens* L.; Mandalay, 27-X-1971 (IMI 161583); Yezin, 5-IX-1977 (LAM 220211).

Note: Stromata present; conidiophores: loosely fasciculate, flexuous, simple, pale to medium brown, subhyaline near the tip, uniform in width, geniculate, multiseptate, 28-120 x 4 µm; condia acicular to obclavate, hyaline, multiseptate, 52-204 x 4 µm.

C. *umbrata* Ell. & Holway on leaves of *Coreopsis tinctoria* Nutt; Rangoon, 7-III-1980 (LAM 220905).

Note: Conidiophores: olivaceous brown, loose to fairly fasciculate, simple, aseptate, tortuous towards the apex or geniculate, obtuse at the apex, upto 41 x 4-4.5 µm; conidia pale olivaceous, usually obclavate with obconically truncate base and obtuse apex, 3- or more-septate, 40.5-55.5 x 3.5-4.5 µm.

C. xanthiicola Heald & Wolf on leaves of *Xanthium strumarium* L.; Mandalay, 2-II-1973 (IMI 172867a).

C. zinniae Ell. & Mart. on leaves of *Zinnia elegans* Jacq. and *Zinnia* species; Mandalay, 30-X-1971 (LAM 220209), 25-XI-1971 (IMI 162846).

Cercospora species on leaves of *Enhydra fluctuans* Lour.; Mandalay, 3-II-1973 (IMI 172874).

Note: Stromata none; conidiophores: loosely fasciculate, brown, septate, strongly geniculate towards the apex, with prominent scars, flexuous, obtuse at the apex, 87.5 x 5 µm; conidia: oblongo-obclavate, obconico-truncate at base, pale, indistinctly 2-8 septate, 24-81 x 2.5-4 µm.

Cercospora species on leaves of *Callistephus chinensis* Nees; Rangoon (Vegetable Bazaar), 20-X-1979 (LAM 220722).

Note: Conidia: sybhyaline, linear to slightly acicular, multiseptate, with a dark scar at the truncate base, and subobtuse apex, 90-166.5 (-185) x 2.5-3.5 µm. A *Mycosphaerella* species (LAM 220775) has been recorded on this host plant species from the same location.

Cercospora species on leaves of *Jaegeria hirta* (Lag.) Lass.; Yezin, 11-XII-1973 (IMI 181636).

Note: It belongs to *C. apii* group.

Mycovellosiella ferruginea (Fuckel) Deighton on leaves of *Artemisia vulgaris* L.; Mandalay, 25-I-1974 (IMI 182563).

Phaeoramularia tithoniae (Baker & Dale) Deighton on leaves of *Tithonia tagetifolia* Desf.; Mount Popa, 17-IX-1972 (IMI 170084); Kalaw, 16-XII-1977 (LAM 220360); on leaves of *T. diversifolia* A. Gray; Rangoon, 18-X-1979 (LAM 220600).

Note: Conidiophores 16-80 x 4 µm; conidia 36-58 x 3-4 µm.

Pseudocercospora blumeae (Thumen) on leaves of *Blumea laciniata* (Roxb.) DC; Rangoon, 15-XII-1979 (LAM 220710).

P. synedrellae (Yen & Gilles) Deighton on leaves of *Synedrella nodiflora* (L.) Gaertn.; Rangoon, 6-II-1980 (LAM 220802).

Note: Conidia colored, attenuato-cylindric to obclavate or subacicular with subtruncate to truncate base and subobtuse to obtuse apex.

P. pterocauli (Petrak) Deighton on leaves of *Pterocaulon* species (Ellis, 1976).

CONVOLVULACEAE

Cercospora ipomoeae Wint. on leaves of *Ipomoea bonanox* L.; *I. reptans* Poir, *I. sepiaria* Koen., *Ipomoea* species; Mandalay, 1-X-1971 (IMI 160464), 7-XII-1971 (IMI 163009); Rangoon, 21-VIII-1973 (IMI 179306); Kyaukse, 3-XII-1977 (LAM 220517); Aungban, 27-XII-1979 (LAM 220807).

Note: Conidiophores: olivaceous brown, paler towards the apex, multiseptate, geniculate, simple, subtruncate at the apex; conidia: acicular to obclavate, pale olivaceous, straight to curved, indistinctly multiseptate, base truncate with a hilum, 64-104 (-120) x 3-4 µm.

CRUCIFERAE

Cercospora brassicicola P. Henn. on leaves of *Brassica alba* Hook f. & T. and *B. oleracea* L. sub. sp. *caulorapa*; Mandalay, 8-III-1971 (IMI 155749); Myitkyina, 26-XII-1977 (LAM 220524); Amarapura, 30-IX-1979 (LAM 220697); Rangoon, 10-I-1980 (LAM 220809).

Note: Conidiophores 40-124 x 4-6 µm; conidia 24-108 x 4-5 µm.

C. cruciferarum Ell. & Ev. on leaves of *Raphanus sativus* L.; Sandoway, 21-I-1978 (LAM 220463).

CUCURBITACEAE

Cercospora citrullina Cke. on leaves of *Coccinia indica* W. & A., *Cucumis sativus* L., *Cucurbita maxima* Duch., *Cucurbita pepo* Lour., *Lagenaria vulgaris* Ser., *Luffa aegyptiaca* Mill., *L. amara* Roxb., *Momordica charantia* L., and *Trichosanthes anguina* L.; Rangoon, 27-IX-1979 (LAM 220591), 21-X-1979 (LAM 220590), 8-XI-1979 (LAM 220686), 16-XI-1979 (LAM 220694); Insein, 29-IX-1979 (LAM 220592, 220593, 220594); Hmawbi, 26-X-1979 (LAM 220589); Henzada, 2-XI-1979 (LAM 220690); Gyogon, 10-X-1979 (LAM 220713); Mandalay, 5-II-1970 (IMI 146680), 12-X-1971 (IMI 161271b), 9-X-1972 (IMI 170095).

Note: Stromata small, brown; conidiophores 48-320 x 4-5 µm; conidia 24-248 x 2-5 µm.

DIOSCOREACEAE

Cercospora carbonacea Miles on leaves of *Dioscorea* species; Mandalay, 6-X-1974 (IMI 188961).

EHRETIACEAE

Cercospora species on leaves of *Coldenia procumbens* L.; Thazi, 25-XII-1979 (LAM 220813).

Note: Conidia: pale olivaceous, obclavate to acicular, cylindric when short, 2-5 septate, smooth, 56-65 x 3.5-4.5 µm.

Cercospora species on leaves of *Cordia fragrantissima* Kurz and *Cordia* species; Pyinmana, 3-I-1973 (IMI 172873); Mandalay, 7-XII-1971 (IMI 163014b).

Note: Similar to *C. apii* Fres. in character.

EUPHORBIACEAE

Cercospora acalyphae Peck on leaves of *Acalypha* species; Yezin, 11-XII-1973 (IMI 181630).

C. baliospermi Pavgi & Singh on leaves of *Baliospermum montanum* Muell Arg.; Rangoon, 30-I-1975 (IMI 191514).

C. pulcherrimae Tharp on leaves of *Euphorbia neriifolia* L.; Myaungmya, 13-XI-1979 (LAM 220693).

C. ricinella Sacc. & Berl. on leaves of *Ricinus communis* L.; Mawlaik, 15-V-1971 (IMI 157611), 2-V-1972 (LAM 220104); Rangoon, 4-II-1978 (LAM 220354).

Cercosporidium henningsii (Allesch.) Deighton on leaves of *Manihot utilissima* Pohl; Mergui, 12-X-1971 (IMI 161274); Hmawbi, 26-X-1979 (LAM 220609); Rangoon, 20-IX-1979 (LAM 220610), Rhind & Seth (1945).

Phaeoramularia ajrekari (H. & P. Syd.) Deighton on leaves of *Jatropha curcas* L.; Rangoon, 10-III-1973 (IMI 175734).

Pseudocercospora baliospermi (Chowdhury) Deighton on leaves of *Baliospermum axillare* Blume; Mingun, 12-X-1971 (IMI 161278).

P. phyllanthi (Chupp) Deighton on leaves of *Phyllanthus emblica* L. and *P. niruri* L.; Toungoo, 10-I-1978 (LAM 220438), 11-XII-1979 (LAM 220721); Aungban, 27-XII-1979 (LAM 220814).

Note: Conidia pale, cylindric or obclavate with subtruncate base and subacute apex, multiseptate, (37-) 77.5-85 x 3-5 µm. A *Mycosphaerella* species found as one of its consociates has the following characteristics: Colonies dark, discrete, dot-like with disc-like depressions; ascomata: globose to depressed-globose, immersed to erumpent, 66-100 x 55-74 µm, aparaphysate; wall pseudoparenchymatous, upto about 7.5 µm thick; asci: bitunicate, sybcylindric to cylindric, parallel, 30-37 x 7.5 µm; ascospores:

clavulate, subhyaline, guttulate, 1-septate about the middle, smooth, 11-13 x 3-3.5 µm, upper cell frequently slightly broader.

FAGACEAE

Cercospora canescens Ell. & Mart. on leaves of *Quercus* species; Maymyo, 18-V-1975 (IMI 194477).

FUMARIACEAE

Cercospora species on leaves of *Fumaria parviflora* Lam.; Rangoon, 5-XII-1979 (LAM 220706).

Note: Conidiophores: loose, brown, simple, septate, flexuous, uniform in width, geniculate, 166.5-222 x 4.5 µm; conidia: hyaline, acicular, straight or curved, multiseptate, truncate at base, subacute at apex, (67-) 89-100 (-163) x 3-4 µm.

GRAMINEAE

Cercospora canescens Ell. & Mart. on grasses; Kyaukchaw, 12-XI-1974 (IMI 190424, 190428b); Rangoon, 30-IX-1975 (IMI 197639), 20-VII-1979 (LAM 220518); Yezin, 25-V-1977 (LAM 220114).

C. oryzae Miyake on leaves of *Oryza sativa* L.; Rangoon, 25-VIII-1975 (IMI 197640); Hlegu, 3-I-1978 (LAM 220362), Rhind & Seth (1945).

C. sorghi Ell. & Ev. on leaves of *Sorghum dochna*, *S. roxburghii*, *S. vulgare* Pers. and *Zea mays* L.; Mandaya, 2-X-1973 (IMI 173530); Tadau, 17-XII-1977 (LAM 220439), Rhind & Seth (1945).

Cercospora species on leaves of *Coix Lachryma-jobi* L.; Rangoon, 6-XI-1973 (IMI 180758), 29-IX-1979 (LAM 220582).

Note: Stromata small; conidiophores pale brown, simple or branched, geniculate, uniform in width, 3-4-septate, 46-136 x 5-6 µm; conidia cylindro-obclavate, pale, multiseptate, (28-) 40-68 (-120) x 3-5 µm.

Cercospora species on leaves of *Pennisetum typhoides* Stapf. & Hubbard; Myingyan, 16-I-1978 (LAM 220515).

Note: Conidia mostly acicular, pale olivaceous, multiseptate, truncate or short obconically truncate at base with a dark hilum, subacute at the apex.

Cercospora species on leaves of *Phragmites* species; Kyaunggon, 10-XII-1977 (LAM 220526).

Note: Conidia linear to narrowly obclavate, hyaline, septate with truncate base and dark hila.

Mycovellosiella koepkei (Krüger) Deighton on leaves of *Saccharum officinarum* L.; Namsan, 11-I-1978 (LAM 220361), Rhind & Seth (1945).

Mycovellosiella species on leaves of *Arundo donax* L.; Rangoon, 30-III-1973 (IMI 175736).

Note: Conidiophores brown, septate, geniculate; conidia short, brown, Indian club-shaped, 1-septate, occasionally with denticles at the base and hila.

Ramulispora sorghi (Ell. & Ev.) Olive & Lefebvre on leaves of *Sorghum vulgare* Pers.; Kyaukpadaung, 25-XII-1977 (LAM 220460).

HYDRANGEACEAE

Cercospora hydrangeae Ell. & Ev. on leaves of *Hydrangea macrophylla* (Thumb.) Ser. ex DC; Yawnshwe, 1-V-1974 (IMI 185237).

LABIATAE

Cercospora leucadis Thirum. & Govindu on leaves of *Leucas aspera* Spreng; Yezin, 16-XI-1979 (LAM 220692).

C. menthicola Tehon & Daniels on leaves of *Mentha piperita* L.; Rangoon, 5-XII-1979 (LAM 220699).

Cercospora species on leaves of *Elsholtzia eriostachya* Benth.; Pindaya, 28-XII-1979 (LAM 220792).

Pseudocercospora ocimicola (Petr. & Cif.) Deighton on leaves of *Ocimum americanum* L. and *O. sanctum* L.; Yezin, 20-XII-1973 (IMI 181633); Rangoon, 23-IX-1979 (LAM 220615).

LEGUMINOSAE

Cercospora alysicarpi Munjal, Lall & Chona on leaves of *Alysicarpus vaginalis* DC; Rangoon, 5-XII-1979 (LAM 220707).

Note: Conidiophores: brown, simple, septate, irregular in width, geniculate, 111 x 5 µm; conidia: hyaline, acicular, truncate at base and subacute at apex, or obclavate and obconico-truncate at base and subobtuse to obtuse at apex, or cylindric when short, multiseptate, (40.5-) 55.5-103.5 (-174) x 3-5 µm (usually 74-82 (-103.5) x 3-5 µm), straight or curved.

C. arachidicola Hori on leaves of *Arachis hypogea* L.; Daiku, 5-XII-1977 (LAM 220355a).

C. canescens Ell. & Mart. on leaves of *Canavalia ensiformis* DC; *Dolichos lablab* L., *Erythrina* species, *Phaseolus aconitifolius* Jacq., *P. lunatus* L., *P. mungo* L., *P. radiatus*

L., *Vigna catjang* Walp.; Amarapura, 4-IV-1971 (IMI 156318, 156320a); Mandalay, 8-III-1971 (IMI 155750), 1-XI-1971 (IMI 162859), 25-XI-1971 (IMI 162843), 28-I-1972 (IMI 163847), 1-II-1973 (IMI 173543); Sagaing, 7-XII-1971 (IMI 163010); Thazi, 25-XI-1971 (IMI 162844, 162848a); Henzada, 6-XII-1977 (LAM 220467); Labutta, 20-XII-1977 (LAM 220356a); Myingyan, 1-XII-1979 (LAM 220719, 220720); Pauk, 12-XII-1978 (LAM 220716); Pyinmana, 20-IX-1977 (LAM 220469).

Note: A *Mycosphaerella* species (IMI 162838c) and *M. erythrinicola* Syd. (IMI 162859b) are also found as ones of its consociates.

C. dolichi Ell. & Ev. on leaves of *Dolichos lablab* L. and *Vigna catjang* Walp.; Mandalay, 25-XI-1971 (IMI 162847); Mogaung, 9-I-1978 (LAM 220468); Henzada, 6-XII-1977 (LAM 220470), 8-XII-1978 (LAM 220724); Rhind & Seth (1945).

C. erythrinae Ell. & Ev. on leaves of *Erythrina* species; Rangoon, 26-VIII-1975 (IMI 197647); Myitkyina, 10-VIII-1972 (LAM 220803).

C. glauca Syd. on leaves of *Albizzia kalkora* Prain; Rangoon, 24-X-1979 (LAM 220621).

C. hardwarensis Narasimhan apud Govindu & Thirum. on leaves of *Tephrosia purpurea* Pers.; Mandalay, 3-V-1972 (IMI 166359); Thazi, 25-XI-1973 (IMI 180785), 26-XII-1979 (LAM 220800).

C. psophocarpicola Yen on leaves of *Psophocarpus tetragonolobus* DC; Mandalay, 12-I-1972 (IMI 163845, 163846).

C. psoraleae-bituminosae Savul. & Sandu-Ville on leaves of *Psoralea corylifolia* L.; Mandalay, 1-XII-1971 (IMI 163021).

C. pudicae Yen on leaves of *Mimosa pudica* L.; Rangoon, 10-IX-1972 (IMI 171315); Yezin, 5-IX-1977 (LAM 220160); Rhind & Seth (1945).

C. simulata Ell. & Ev. on leaves of *Cassia alata* L. and *C. obtusa* Roxb.; Rangoon, 10-XI-1973 (IMI 180756), 5-XII-1979 (LAM 220704a); Kyaukpadaung, 10-XII-1979 (LAM 220801).

C. ternateae Petch on leaves and pods of *Clitoria ternatea* L.; Mandalay, 12-X-1971 (IMI 161277), 27-XI-1971 (LAM 220108); Rangoon, 1-X-1979 (LAM 220715).

C. traversiana Sacc. on leaves of *Trigonella foenum-graecum* L.; Mandalay (Rhind & Seth, 1945).

Cercospora species on leaves of *Tamarindus indica* L.; Rangoon, 11-XI-1979 (LAM 220727).

Cercosporidium personatum (Berk. & Curt.) Deighton on leaves of *Arachis hypogaea* L.; Daiku, 5-XII-1977 (LAM 220355b);

Rhind & Seth (1945).

Mycovellosiella cajani (P. Henn.) Rangel ex Trotter on leaves of *Cajanus indicus* Spreng; Rangoon, 3-VIII-1972 (IMI 169348); Loilem, 28-XII-1977 (LAM 220769).

Phaeoramularia occidentalis (Cke.) Deighton on leaves of *Cassia glauca* Lamark; Myitnge, 10-XI-1971 (IMI 162842), 1-VI-1972 (LAM 220106).

Pseudocercospora angustata (Chupp & Solheim) Deighton on leaves of *Cassia fistula* L.; Rangoon, 1-I-1974 (IMI 181637), 14-X-1979 (LAM 220601).

P. cotizensis (Muller & Chupp) Deighton on leaves of *Crotalaria striata* DC; Rangoon, 28-IX-1979 (LAM 220586).

P. cruenta (Sacc.) Deighton on leaves of *Vigna catjang* Walp.; Mandalay, 2-XI-1971 (IMI 162849); Myingyan, 20-XII-1977 (LAM 220353).

P. nigricans (Cke.) Deighton on leaves of *Cassia auriculata* L., *C. occidentalis* L., *C. renigera* Wall, *C. sophera* L., and *C. tora* L.; Mandalay, 12-X-1971 (IMI 161272); Thazi, 25-XI-1973 (IMI 180781, 180782); Rangoon, 10-XI-1975 (IMI 200321), (LAM 220036); Maymyo, 19-IV-1972 (LAM 220103).

P. psophocarpi (Yen) Deighton on leaves of *Psophocarpus tetragonolobus* DC; Hmawbi, 26-X-1979 (LAM 220611); Belukyun, 20-XII-1979 (LAM 220712).

Note: Conidiophores 1-2 present; conidia pale olivaceous, smooth, straight or curved, 3-5 septate, attenuato-cylindric, obtruncate at base and obtuse at apex, 37-41 x 3.5 µm.

P. sesbaniae (P. Henn.) Deighton on leaves of *Sesbania grandiflora* Pers. and *Sesbania* species; Mandalay, 10-I-1972 (IMI 163848, 163849), 28-XII-1974 (LAM 220139); Rangoon, 21-X-1979 (LAM 220619), 20-X-1979 (LAM 220718).

P. stizolobii (H. & P. Syd.) Deighton on leaves of *Mucuna pruriens* DC; Monywa, 23-XII-1973 (IMI 182565).

Stenella canavaliae (H. & P. Syd.) Deighton on leaves of *Canavalia ensiformis* DC; Shwebo, 24-XII-1977 (LAM 220902).

Note: Conidia 44.5-57.5 x 5.5-7.5 µm, upto 6-septate.

LYTHRACEAE

Cercospora lythracearum Heald & Wolf on leaves of *Lagerstroemia speciosa* Pers.; Kyaungkon, 17-XII-1977 (LAM 220520); Rangoon, 15-X-1979 (LAM 220607a).

MALVACEAE

Cercospora althaeina Sacc. on leaves of *Althaea rosea* L.; Mandalay, 5-II-1970 (IMI 146675).

C. gossypina Cke. on leaves of *Gossypium* species (cotton); Mandalay, 3-VI-1973 (IMI 176163); Gyogon, 14-X-1979 (LAM 220604).

C. hyalospora Muller & Chupp on leaves of *Sida spinosa* L. and *Sida* species; Mandalay, 12-X-1974 (IMI 188965); Gangaw, 24-I-1978 (LAM 220521); Henzada, 2-XI-1979 (LAM 220691).

C. malachrae Heald & Wolf on leaves of *Urena lobata* L.; Mandalay, 2-II-1973 (IMI 172866); Insein, 29-IX-1979 (LAM 220595).

Pseudocercospora abelmoschi (Ell. & Ev.) Deighton on leaves of *Hibiscus cannabinus* L., *H. esculentus* L., *and H. sabdariffa* L.; Mandalay, 1-XII-1971 (IMI 163011), 19-XII-1977 (LAM 220445), 24-I-1978 (LAM 220516); Henzada, 2-XI-1979 (LAM 220687); Gyogon, 15-XII-1979 (LAM 220688, 220689); Rhind & Seth (1945).

Ramularia gossypii (Speg.) Cif. on leaves of *Gossypium* species (cotton); Kyaukchaw, 1-I-1974 (IMI 181640); Taungtha, 18-XII-1977 (LAM 220343).

MARSILEACEAE

Cercospora marsileae Ragunathan, Prasad & Purushothaman on leaves of *Marsilea quadrifoliata* L.; Mandalay, 3-III-1973 (IMI 173542), 15-I-1974 (IMI 181643a).

Note: Stromata just a few cells; conidiophores: brown, geniculate, regular in width, truncate at the apex with dark scar, 106.25-108.75 x 3.75-5 µm; conidia: hyaline, acicular, truncate at base with a dark hilum, septate, 75-127.50 x 3.75 µm. Ragunathan et al. mistakenly described the acicular shape of the conidia (see their Fig. 2) of their specimen as cylindrical. It belongs to *C. apii* group; possibly a *Sphaerulina* (IMI 181643b) is also found as its consociate.

MELIACEAE

Cercospora species on leaves of *Chukrasia tabularis* A. Juss.; Maymyo, 3-XI-1977 (LAM 220226).

Pseudocercospora subsessilis (H. & P. Syd.) Deighton on leaves of *Melia azadirachta* L.; Mandalay, 15-III-1972 (IMI 166352); Taungwingyi, 17-XII-1977 (LAM 220444).

MENISPERMACEAE

Phaeoisariopsis menispermi (Ellis & Holway) Deighton on leaves of *Cocculus villosus* DC; Mandalay (Rhind & Seth, 1945).

Cercosporella tinosporae (Lacy & Thirum.) Deighton on leaves of *Tinospora cordifolia* Miers; Mandalay, 21-IX-1971 (IMI 160463), 2-XI-1973 (LAM 220105).

Note: *Mycosphaerella tinosporae* Ajrekar ex Mundkur has been reported on this host plant species in India.

Pseudocercospora cocculi (H. Syd.) Deighton on leaves of *Cocculus villosus* DC; Mandalay, 1-XII-1971 (IMI 163022), 28-XII-1972 (LAM 220107).

MORACEAE

Fulvia fulva (Cke.) Cif. on leaves of *Broussinetia papyrifera* Vent; Taungtha, 1-I-1978 (LAM 220304).

Pseudocercospora fici-chartaceae (Yen & Lim) Yen on leaves of *Ficus* species; Yezin, 28-XI-1977 (LAM 220257d); Rangoon, 26-X-1979 (LAM 220613, 220614).

Note: Conidia pale olivaceous, cylindro-obclavate, multiseptate, 60 x 3.5 µm, with obconic base and subobtuse apex.

P. mori (Hara) Deighton on leaves of *Morus alba* L. and *Morus* species; Tadau, 26-XII-1972 (IMI 172457); Rangoon, 5-XII-1979 (LAM 220700).

MORINGACEAE

Cercospora moringae Thirum. & Govindu on leaves of *Moringa oleifera* Lam.; Rangoon, 18-X-1979 (LAM 220622).

MYRTACEAE

Cercospora species on leaves of *Eucalyptus* species; Mandalay, 20-I-1973 (IMI 172865), 24-XI-1973 (IMI 180778b); Rangoon, 20-IX-1979 (LAM 220618).

Note: Stromata globose, 37.5-50 (-62.5) µm in dia.; conidiophores pale olivaceous brown, 12.5-18.75 x 1.25-2.5 µm; conidia pale, cylindro-elongate to subobclavato-cylindric, truncate at base, slightly attenuate towards the apex, septate, 50-62.5 x 2.5 µm. This is not *C. eucalypti* Cke. & Massee, and initials of a perfect state (probably a *Mycosphaerella*) are seen.

NYCTAGINACEAE

Cercospora boerhaaviicola Thirum. & Govindu on leaves of

Boerhaavia diffusa L.; Pauk, 10-XII-1977 (LAM 220466).

Note: Characters are somewhat similar to those of a *Cercosporidium.*

C. furfurella Speg. on leaves of *Boerhaavia diffusa* L.; causing entirely pinkish to greyish white spots with brown margin; Rangoon, 5-XII-1979 (LAM 220702).

Note: Conidia hyaline, acicular to obclavate, upto 111 µm long and 2.5-4.5 (-5) µm wide.

OLEACEAE

Cercospora species on leaves of *Jasminum* species; Mandalay, 11-XI-1971 (IMI 162856).

Note: Stromata globular to irregular, 50-75 µm in dia.; conidiophores loosely fasciculate, brown, simple, erect to flexuous, almost regular in width, multiseptate, cicatrized, slightly geniculate near the apex, apex conicotruncate, 100-125 x 3.75 µm; conidia hyaline, acicular to cylindric, truncate at the base with thickened hilum, septate, not constricted, 31-50 x 3.75 µm. Thus this taxon is morphologically similar to *C. apii* Fres.

Cercospora species on leaves of *Fraxinus griffithii* C. B. Clarke; Maymyo, 12-II-1974 (IMI 185227a).

Note: Stromata large; conidiophores pale, tortuous, septate, branched; conidia subhyaline, shortly cylindric to obclavate, obconically truncate, apically obtuse, septate. This is not a typical *Cercospora.*

Pseudocercospora jasminicola (Muller & Chupp ex) Deighton on leaves of *Jasminum grandiflorum* L. and *J. sambac* Ait; Mandalay, 1-X-1971 (IMI 161275); Monywa, 1-X-1973 (IMI 180187); Pindaya, 28-XII-1979 (LAM 220794); Meiktila, 19-I-1978 (LAM 220799).

Note: Conidia 48-120 x 4-4.5 µm, 3-9 septate.

OLEANDRACEAE

Cercospora phyllitidis Hume on leaves of *Nephrolepsis* species; Rangoon, 5-IV-1973 (IMI 175733).

ONAGRACEAE

Pseudocercospora jussiaeae (Atk.) Deighton on leaves of *Jussiaea suffructicosa* L.; Rangoon, 5-XI-1973 (IMI 180757); Insein, 29-IX-1979 (LAM 220597).

OPHIOGLOSSACEAE

Pseudocercospora helminthostachydis (P. Henn.) Deighton on leaves of *Helminthostachys zeylanica* Hook; Kanbalu, 21-II-1973 (IMI 173533).

OXALIDACEAE

Gloeocercospora species on leaves of *Oxalis corniculata* L.; Maymyo, 16-XII-1975 (IMI 199754).

PAPAVERACEAE

Cercospora papaveri Nakata on leaves of *Papaver somniferum* L.; Pinlong, 10-XII-1976 (LAM 220116).

Note: Conidia obclavato-cylindric to subacicular, with subtruncate to obconico-truncate base and subobtuse apex, pale olivaceous brown, multiseptate, 43.75-87.50 x 3-3.75 µm.

PASSIFLORACEAE

Cercospora fusco-virens Sacc. on leaves of *Passiflora foetida* L.; Mandalay, 17-XII-1974 (IMI 191516a).

Pseudocercospora stahlii (F. L. Stev.) Deighton on leaves of *Passiflora foetida* L.; Rangoon, 1-VIII-1979 (LAM 220549).

Note: Mycelium internal, about 2 µm wide. Stromata small, 11 x 9.5-11 µm. Conidiophores pale brown, profusely branched, 254 x 3.5-4 (-6) µm, denticulate, slightly or distinctly geniculate or not at the denticles, denticles peg-like with thickened scar, truncate, (1-) 2-3.7 x 1-2 µm, scar about 1 µm thick, sympodial. Conidia acrogenous, solitary, pale brown, smooth, simple, straight, fusoid when immature, broadly clavate (with rounded/obtuse apex) to cylindric with the proximal cell attenuated into a narrow truncate base or a protuberant hilum, 3-5 septate (but usually 3-septate), sometimes slightly constricted at the septa, 33.5-37 (-42.5) x 4.5-7.5 (-8.5) µm, base truncate, about 2 µm wide and when protuberant 3.5-4 x 2 µm.

PEDALIACEAE

Cercospora sesami Zimm. on leaves of *Sesamum orientale* L.; Tatkon, Rhind & Seth (1945).

Cercoseptoria sesami (Hansf.) Deighton on leaves of *Sesamum indicum* L.; Myaungmya, 10-VII-1971 (IMI 169349); Yezin, 11-XII-1973 (IMI 181627); Henzada, 6-XII-1977 (LAM 220461); Kyonpyaw, 30-XII-1978 (LAM 220711); Myitkyina, 19-VI-1980 (LAM 220937).

PERIPLOCACEAE

Cercospora species on leaves of *Streptocaulon tomentosum* Wight & Arn., causing irregular to angular greyish spots with dark brown margin; Pyawbwe, 27-XII-1972 (IMI 172869);

Meiktila, 2-II-1975 (LAM 220212).

Note: Colonies amphigenous; stromata small; conidiophores pale brown, simple, septate, geniculate, 80-400 x 4-5 µm; conidia hyaline, acicular, multiseptate, 60-264 x 2-4 µm.

PIPERACEAE

Cercospora piperata Asthana & Mahmud on leaves of *Piper betle* L., *P. longum* L., and *P. nigrum* L.; Madaya, 16-XII-1977 (LAM 220357); Mandalay, 8-I-1978 (LAM 220358); Toungoo, 5-I-1978 (LAM 220465).

PLUMBAGINACEAE

Cercospora insulana Sacc. on leaves of *Limonium bouduellii* Kuntz; Taunggyi, 1-V-1973 (IMI 175750); Kalaw, 28-XII-1979 (LAM 220793).

Cercospora species on leaves of *Plumbago zeylanica* L.; Rangoon, 13-I-1980 (LAM 220789).

Note: Conidia pale or subhyaline, multiseptate, subacicular with a subtruncate base and subacute apex or subobclavate with a roundish base and obtuse apex, upto 237 x 4-5 µm.

POLEMONIACEAE

Cercospora omphacodes Ell. & Holway on leaves of *Phlox drummondii* Hk.; Rangoon, 7-III-1980 (LAM 220909).

POLYGONACEAE

Cercospora avicularis Wint. on leaves of *Polygonum assamicum* Meissn and *P. tomentosum* L.; Mandalay, 19-X-1971 (IMI 170564); Rangoon, 13-I-1980 (LAM 220786).

PTERIDACEAE

Cercospora pteridis Siemaszko on leaves of *Pterix* species; Rangoon, 20-I-1975 (IMI 191518).

PUNICACEAE

Pseudocercospora punicae (P. Henn.) Deighton on leaves of *Punica granatum* L.; Mandalay, 10-XI-1973 (IMI 187218a); Loilem, 29-XII-1977 (LAM 220522).

RHAMNACEAE

Cercospora jujubae Chowdhury on leaves of *Zizyphus jujuba* Lam.; Mandalay, 23-III-1971 (IMI 155994), 10-III-1975 (LAM 220055).

ROSACEAE

Cercospora circumscissa Sacc. on leaves of *Prunus cerasus* L.; Kalaw, 21-I-1978 (LAM 220442).

C. prunicola Ell. & Ev. on leaves of *Prunus cerasoides* D. Don; Maymyo, 15-XI-1972 (IMI 177238).

C. rosicola Passerini on leaves of *Rosa* species (rose); Pyinmana, 2-XII-1970 (IMI 153661a); Mandalay, 4-XI-1977 (LAM 220232); Mogaung, 6-I-1978 (LAM 220443).

Note: *Mycosphaerella rosicola* Davis ex Deighton (IMI 153661a) is also present as its consociate.

Fusicladium virescens Bonor. on leaves of *Pyrus communis* L.; Kutkhine, 15-XII-1977 (LAM 220474).

Pseudocercospora mali (Ell. & Ev.) Deighton on leaves of *Pyrus communis* L.; Kyaukme, 12-I-1978 (LAM 220359).

Stenella species on leaves of *Eriolobus hookeriana* Dcne.; Maymyo, 15-II-1974 (IMI 183213a).

RUBIACEAE

Cercospora adinae T. S. & K. Ramakrishnan on leaves of *Adina cordifolia* Hook. f.; Pyinmana, 1-I-1973 (IMI 172871), 9-IX-1977 (LAM 220525); Rangoon, 10-XII-1979 (LAM 220714).

Note: Stromata present, mostly intraepidermal; conidiophores loosely fasciculate, simple or branched, brown, 0-1 septate, 28-36 x 3-4 µm; conidia pale, obclavate to cylindric, 1-4 septate, straight or curved, 37.5-72.5 x 3-4 µm.

C. coffeicola Berk. & Cke. on leaves of *Coffea arabica* L.; Maymyo, 1-III-1972 (IMI 166360), Leiktho (Rhind & Seth, 1945).

Pseudocercospora species on leaves of *Gardenia turgida* Roxb.; Maymyo, 7-X-1974 (IMI 188951a).

RUTACEAE

Cercospora aeglicola S. Das. on leaves of *Aegle marmelos* Corr.; Mandalay, 12-XI-1972 (IMI 177245).

SALICACEAE

Pseudocercospora salicina (Ell. & Ev.) Deighton on leaves of *Salix* species; Yezin, 25-V-1977 (LAM 220115).

SAPINDACEAE

Cercospora cardiospermi Petch on leaves of *Cardiospermum* *helicacabum* L.; Mandalay, 2-X-1979 (LAM 220682).

SAXIFRAGACEAE

Cercospora species on leaves of *Saxifraga virginensis* Michx.; Rangoon, 5-XII-1979 (LAM 220708).

Note: Conidia pale, obclavate, obconico-truncate at base and subobtuse to obtuse at apex, 3-5 septate, 38.5-44.5 x 3.5 µm.

SCROPHULARIACEAE

Pseudocercospora scopariicola (Yen) Deighton on leaves and fruits on *Scoparia dulcis* L.; producing only faint brownish discoloration; Rangoon, 5-XII-1979 (LAM 220709).

Note: Conidiophores brown, simple, septate, loosely fasciculate, wavy to geniculate towards the apex, upto 33 x 3.5 µm; conidia colored, obclavate to cylindric, obconico-truncate at base and obtuse at apex, multiseptate, straight or curved, upto 111 (-140) µm long and 3-3.5 µm wide.

SOLANACEAE

Cercospora capsici Heald & Wolf on leaves of *Capsicum annum* L.; Amarapura, 23-III-1971 (IMI 155995); Lashio, 12-XII-1977 (LAM 220365).

C. daturicola (Speg.) Vassiljevsky on leaves of *Datura fastuosa* L.; Mandalay, 7-XII-1971 (IMI 163008).

C. melongenae Welles on leaves of *Solanum melongena* L.; Mandalay, 12-I-1974 (IMI 181635a).

C. nicotianae Ell. & Ev. on leaves of *Nicotiana tabacum* L.; Amarapura, Rhind & Seth (1945).

C. petuniae (Saito) Muller & Chupp on leaves of *Petunia* species; Rangoon, 8-IV-1979 (LAM 220464).

C. solani de Thuemen on leaves of *Solanum melongena* L.; Mandalay, Rhind & Seth (1945).

C. solanicola Atk. on leaves of *Solanum torvum* Swartz; Rangoon, 21-XII-1979 (LAM 220811); Mandalay, 26-XI-1973 (IMI 180783).

C. solani-melongenae Chupp on leaves of *Solanum melongena* L.; Yezin, 8-XII-1977 (LAM 220437).

Phaeoramularia capsicicola (Vassiljevsky) Deighton on leaves of *Capsicum annum* L.; Amarapura, 11-III-1971 (IMI 155996).

Pseudocercospora atro-marginalis (Atk.) Deighton on leaves of *Solanum nigrum* L.; Mandalay, 10-II-1973 (IMI 173531).

P. modesta (Syd.) Deighton on leaves of *Solanum indicum* L.; Rangoon, 13-I-1980 (LAM 220787).

TILIACEAE

Cercospora corchori Sawada on leaves of *Corchorus acutangulus* Lam.; Taungmyo, 1-XII-1973 (IMI 181632).

Mycovellosiella grewiae (Sriv. & Mehta) Deighton on leaves of *Grewia ?macrophylla* King; Kyaukchaw on the way to Maymyo, 26-IX-1974 (IMI 188948).

ULMACEAE

Cercospora holopteleae Chiddarwar on leaves of *Holoptelea integrifolia* Planch; Mandalay, 28-I-1974 (IMI 185226); Pyinmana, 30-XII-1977 (LAM 220812).

Note: Conidiophores in a dense fascicle emerging by rupturing host tissue; conidia obclavate to cylindric with obconico-truncate base and obtuse apex, multiseptate, rather deep brown, straight or bent, upto 44.5 x 3.5-5.5 (-6.5) µm.

UMBELLIFERAE

Cercospora apii Fres. on leaves of *Apium graveolens* L.; Mandalay, 4-I-1972 (LAM 220138a); Amarapura, 30-IX-1979 (LAM 220698).

Cercospora species on leaves of *Coriandrum sativum* L.; Rangoon, 27-IX-1979 (LAM 220626).

Note: Conidia hyaline, acicular, multiseptate.

Cercosporidium punctum (Lacr.) Deighton on leaves and stems of *Anethum graveolens* L. and *Foeniculum vulgare* Gaertn.; Maymyo, 3-III-1969 (IMI 139147); Amarapura, 23-II-1973 (IMI 173529).

Note: Stromata present, subepidermal; conidiophores in groups of 20-36, brown, non-septate, unilaterally 3-6 geniculate, thick-walled on the geniculate side, marked by dark hila at the tips and the kneel-like bulges, 60-72 x 4-8 µm; conidia obclavate, 0-2 septate, hyaline, slightly constricted at the septa, 28-42 x 4-10 µm, with dark hila at the bases. Conidial contents are greenish in color.

URTICACEAE

Cercospora fleuryae Thirum. & Govindu on leaves of *Laportea crenulata* Gaud; Rangoon, 28-IX-1979 (LAM 220587).

C. krugiana Muller & Chupp on leaves of *Boehmeria nivea*

Gaud; Mandalay, 1-XII-1971 (IMI 163006).

VALERIANACEAE

Cercospora species on leaves of *Valeriana hardwickii* Wall.; Rangoon, 18-IV-1980 (LAM 220921b).

VERBENACEAE

Cercospora species on leaves of *Clerodendron macrosiphon* Hook. f.; Nyaunglunt; 20-I-1970 (IMI 146679a); Kyauktaga, 17-XII-1977 (LAM 220351).

Cercospora species on leaves of *Duranta repens* L.; Aungban, 27-XII-1979 (LAM 220788a).

Note: Conidia pale olivaceous, acicular with a truncate base, multiseptate.

C. viticis Ell. & Ev. on leaves of *Vitex negundo* L., and *V. trifolia* L.; Mandalay, 6-X-1974 (IMI 190426); Hmawbi, 26-X-1979 (LAM 220599).

Cercoseptoria clerodendri Pavgi & Singh on leaves of *Clerodendron macrosiphon* Hook. f.; Mandalay, 27-X-1971 (IMI 161580).

Pseudocercospora clerodendri (Miyake) Deighton on leaves of *Clerodendron indicum* (L.) Ktze.; Meiktila, 24-XII-1979 (LAM 220806).

P. guianensis (Stev. & Solh.) Deighton on leaves of *Lantana aculeata* L.; Maymyo, 28-I-1974 (IMI 182584b), 16-II-1974 (IMI 183235); Rangoon, 29-IX-1979 (LAM 220585).

Note: Conidia pale olivaceous, linear to slightly attenuated, truncate at base, septate, upto 93 µm long and 3.5 µm wide.

Ramularia species on leaves of *Nyctanthes arbor-tritis* L.; Rangoon, 20-I-1975 (IMI 191515), 28-IX-1979 (LAM 220627).

Note: Conidia hyaline, attenuato-cylindric with obconico-truncate base or occasionally broadly fusoid, spindle-shaped to subclavate when short, mostly 1-3 septate, straight or slightly bent, 12.5-25 (-56.25) x 2.5-3.75 µm.

VITIDACEAE

Pseudocercospora riachueli (Speg.) Deighton on leaves of *Vitis carnosa* Wall.; Mandalay, 15-X-1971 (IMI 161579).

P. vitis (Lev.) Speg. on leaves of *Vitis vinifera* L.; Kutkhine, 1-X-1971 (IMI 161280); Loilem, 30-XII-1977 (LAM 220528); Insein (Rhind & Seth, 1945).

ZINGIBERACEAE

Cercospora curcumae Govindu & Thirum. on leaves of *Curcuma aromatica* Salisb.; Rangoon, 11-X-1979 (LAM 220624a).

C. hedychii Boedijn on leaves of *Hedychium coronarium* Koenig and *H. spicatum* Ham.; Rangoon, 18-VIII-1975 (IMI 197638a), 30-IX-1979 (LAM 220608).

C. zingibericola Kar & Mandal on leaves of *Zingiber officinale* Roscoe; Mandalay, 2-II-1973 (IMI 172868).

Cercospora species on leaves of *Alpinia officinarum* Hance, *Amomum corynostachyum* Wall., and *Curcuma amada* Roxb., causing indistinct yellowish areas; Rangoon, 5-XII-1979 (LAM 220705), 21-X-1979 (LAM 220625), 21-XI-1979 (LAM 220696), respectively.

Note: Conidia subhyaline, obclavato-cylindric to occasionally linear, obconico-truncate at base, subobtuse to obtuse at apex, multiseptate, straight to slightly curved, (12-23) 27-41 (60-66.5) x 2.5-3.5 µm. A *Mycosphaerella* (LAM 220930) has been recorded on *Alpinia conchigera* Griff. from Myitkyina, Burma.

LITERATURE CITED

Ainsworth, G. C. 1962. Pathogenicity and taxonomy of fungi. Pages 249-269 in G. C. Ainsworth and P. H. A. Sneath, eds. Microbial Classification. 12th Symp. Sec. Gen. Microbiology.

Arx, J. A. von. 1974. The genera of fungi sporulating in pure culture. J. Cramer. Germany. 315 pp.

Butler, E. J. 1918. Fungi and disease in plants. Thacker, Spink & Co., Calcutta. 547 pp.

Carmichael, J. W., W. B. Kendrick, I. L. Conners and L. Sigler. 1980. Genera of hyphomycetes. The University of Alberta Press, Edmonton, 386 pp.

Chesters, C. G. C. 1969. Morphology as a taxonomic criterion. Pages 517-542 in G. C. Ainsworth and A. S. Sussman, eds. The fungi, an advanced treatise. Vol. III. Academic Press, New York.

Chupp, C. 1954. A monograph of the fungus genus Cercospora. Ithaca, New York. 667 pp.

De Hoog, G. S. 1978. Notes on some fungicolous hyphomycetes and their relatives. Persoonia 10:33-81.

Deighton, F. C. 1959. Studies on Cercospora and allied genera. I. CMI Mycological Papers No. 71:1-23.

________. 1967. Studies on Cercospora and allied genera. II. CMI Mycological Papers No. 112:1-80.

________. 1969. Microfungi. IV. CMI Mycological Papers No. 118:1-41.

________. 1971. Studies on Cercospora and allied genera. III. CMI Mycological Papers No. 124:1-13.

________. 1973. Studies on Cercospora and allied genera. IV. CMI Mycological Papers No. 133:1-62.

________. 1974. Studies on Cercospora and allied genera. V. CMI Mycological Papers No. 137:1-75.

________. 1976. Studies on Cercospora and allied genera. VI. CMI Mycological Papers No. 140:1-168.

________. 1979. Studies on Cercospora and allied genera. VII. CMI Mycological Papers No. 144:1-56.

Ellis, M. B. 1971. Dematiaceous hyphomycetes. Commonw. Mycol. Inst., Kew. 608 pp.

________. 1976. More dematiaceous hyphomycetes. Commonw. Mycol. Inst., Kew. 507 pp.

Hawksworth, D. L. 1974. Mycologist's handbook. Commonw. Mycol. Inst., Kew. 231 pp.

Ibrahim, F. M. and E. N. Elamin. 1974. A quantitative morphological classification of thirty species of Cercospora. Mycopathologia et Mycologia applicata 52:141-146.

Ibrahim, F. M. and R. J. Threlfall. 1966. The application of numerical taxonomy to some graminicolous species of Helminthosporium. Proc. Roy. Soc. B, 165:362-388.

Johnson, E. M. and W. D. Valleau. 1949. Synonymy in some common species of Cercospora. Phytopathology 39:763-770.

Kendrick, B. 1978. Recent developments in the systematics of pathogenic fungi. Pages 119-137 in John A. Romberger, ed. Biosystematics in Agriculture. John Wiley & Sons, New York.

________. 1980. The generic concept in hyphomycetes. A reappraisal. Mycotaxon 11:339-364.

________. 1980. Personal communication.

Kendrick, B. and J. W. Carmichael. 1973. Hyphomycetes. Pages 323-509 in G. C. Ainsworth, F. K. Sparrow and A. S. Sussman, eds. The Fungi Vol. IVA. Academic Press, New York.

Kendrick, B. and J. R. Proctor. 1964. Computer taxonomy in the fungi imperfecti. Can. J. Bot. 42:65-87.

Luttrell, E. S. 1978. Biosystematics of Helminthosporium: impact on agriculture. Pages 193-209 in John A. Romberger, ed. Biosystematics in Agriculture. John Wiley & Sons, New York.

Mueller, G. M. 1981. A preliminary taxonometric analysis of the genus Laccaria (Abstract). MSA Newsletter 32:43.

Penzes, A. 1927. Cercospora Hungarica. Folia crypt. Zeitschr. Erforsch. ungar. Kryptfl. 1:288-336.

Pollack, F. G. 1971. Cercospora uromycestri, hyperparasite of rust on Cestrum diurnum. Mycologia 63:689-693.

Rhind, D. and L. N. Seth. 1945. The fungi of Burma. Ind. J. Agri. Sci. 15:142-155.

Sneath, P. H. A. 1966. A comparison of different clustering methods as applied to randomly spaced points. Classification Soc. Bul. 1:2-7.

Solheim, W. G. 1930. Morphological studies of the genus Cercospora. Ill. biol. Monograph 12:1-85.

Sutton, B. C. 1980. Personal communication.

Vasudeva, R. S. 1963. Indian Cercosporae. Indian Council of Agricultural Research, New Delhi, India. 245 pp.

Welles, C. G. 1925. Taxonomic studies of the genus

Cercospora in the Philippine Islands. Amer. J. Bot. 12: 195-218.
Wolfe, C. B. 1981. Numerical taxonomy in the Boletes (Abstract). MSA Newsletter 32:52.
Yen, J. M. and G. Lim. 1980. Cercospora and allied genera of Singapore and the Malay Peninsula. Gardens' Bulletin, Singapore 33:151-232.

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MYCOTAXON

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THREE NEW MARINE *PHYTOPHTHORA* SPECIES FROM NEW SOUTH WALES

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ABSTRACT

Three marine *Phytophthora* spp. from the estuary of the Clyde River at Bateman's Bay, New South Wales, are described as new. The relationships of these species, *P. avicennae, P. batemanensis,* and *P. polymorphica* to others in the genus are discussed. A key to the species of Pythiaceae from marine habitats is given.

INTRODUCTION

Little is known of the mycoflora of the mangrove and estuarine forests of eastern and southern Australia though the forests are of considerable ecological interest (Gill, 1975; Macnae, 1966). In the mangrove forests of the Sydney region, there are extensive unthrifty areas (Clarke & Hanson, 1970) but the causes of decline are not known. Our studies have shown that species of *Phytophthora* are common in these forests.

Mangroves in the Clyde River estuary, Batemans Bay (latitude 35°45'S, 150°09'E) are apparently healthy, and remote from industrial pollution. Only one mangrove species, *Avicennia marina* (Forsk.) Vierh. var. *australasica* (Walp.) Mold. occurs in the area. Input of freshwater into the estuary is minimal over the summer period and the water has a salinity similar to seawater. During a study of the Pythiaceae associated with degradation of recently fallen leaves in the Clyde River estuary, three apparently undescribed species of *Phytophthora* were isolated.

MATERIALS AND METHODS

Fallen leaves, in early stages of decomposition, were collected at low tide from mangrove forests and tidal flats in the estuary of the Clyde river in February 1982. They were rinsed in river water (virtually sea water as the river was tidal at that point) to free them of any adhering sediments, placed in clean plastic bags and kept at 20-26°C for 18 hours.

To isolate *Phytophthora* species, the leaves were washed under running tap water, placed on clean paper towelling, and pieces of leaf approximately 10 x 5 mm were cut from each leaf using a sterile scalpel. Each piece of tissue was immersed in 95% ethanol for 30-60 secs. and plated directly onto 2% V-8 agar prepared with either distilled water or 100% freshly collected seawater. Plates, each with 6 pieces of leaf tissue, were incubated in the dark at room temperature (18-30°C) for 5 days. Colonies were examined under the microscope and isolates with mycelial characteristics similar to those of species of the Pythiaceae were subcultured onto fresh V-8 agar, corn meal agar (CMA), or potato dextrose agar (PDA) for further study.

To induce formation of sporangia two techniques were tested; the cotyledon method (Gerrettson-Cornell, 1980), and flooding of 7-10 day old cultures on 2% V-8 agar with freshly collected seawater. Plates were left at room conditions of light and temperature.

In an attempt to induce formation of oogonia, interspecific pairings were made between each isolate and *P. cinnamomi* Rands A1 and A2 (strains Nos. 8 and 36 from our collection), *P. nicotianae* Breda de Haan var. *parasitica* (Dastur) Waterhouse A1 and A2 (strains DAR 37592, DAR 37594, DAR 37604, DAR 37612) and *P. palmivora* Butler A1 (DAR 37674) and A2 (strain P from our collection) on V8 agar. Plates were incubated at 25° ± 1°C, in darkness for 10 days.

RESULTS

Three groups of isolates were found by us that could not be identified with any of the *Phytophthora* spp. described in the literature. Three new species have been erected. A living culture of each species has been lodged with DAR.

1. *Phytophthora avicennae* Gerrettson-Cornell & Simpson sp. nov.

Summum mycelium pauperum vel absens. Hyphae hyalinae, ramosae, teretes, demum septatae, 5-9 μm diam. *Chlamydosporae* non exhibitae. *Sporangiophora* non ramosa, a primis hyphis saepe distincta, ad basem constricta; non torsiva, 5-12 μm diam., sympodialia. *Sporangia* plures formas habent (ovata, obclavata, irregularia), terminalia, apice saepe rotundo, non papillata, non caduca, non pedicillata, 44-121 x 18-44 μm ($\bar{x}$ = 75x31 μm), teretes. *Zoosporae* in sporangio effectae ad vesiculam aliquando migrantes, reniformes aliisque formis, uno tubo germinale germinantes, 7-12 x 6-8 μm ($\bar{x}$ = 8x7 μm), centraliter biflagellatae. *Reproductio sexualis* ignota.

Holotypus: Cultura sicca et laminae vitreae, ex foliis putrescentibus *Avicenniae* sp., Bateman's Bay, New South Wales, J. Simpson, 23 II.1982 DAR 41560 - Department of Agriculture N.S.W. - Rydalmere.

Cultures on V-8 agar petalloid ('chrysanthemum' like) with scanty, lanose, white aerial mycelium (Fig. 1a); on corn meal agar colonies coralloid, aerial mycelium scanty or absent, hyphae submerged, margin indefinite. Growth rates after 6 days at 25°C, on corn meal agar and V-8 agar, 9 and 33 mm diameter respectively. No growth on PDA.

Hyphae branched, smooth walled, 5-9 μm diameter, coenocytic with some septa in old cultures. Coralloid hyphae singly or in large clusters in CMA (Fig. 2a-b); sparse or in small clusters, in V-8 agar. Swellings not observed.

Chlamydospores not seen.

Sporangiophores often constricted at point of origin from hyphae, otherwise indistinct from vegetative hyphae, up to 1250 μm long, 9-12 μm wide below sporangium ca. 5 μm at point of origin. Branching either sympodial or irregular, branching ca. 5-20 μm below the base of the previously formed sporangium.

Sporangia (Fig. 2c-d) formed abundantly on surface of V-8 agar plates without the use of a liquid medium, but not on corn meal agar. Subhyaline to very pale grey, greyish yellow to pale brown; terminal; ovate to obpyriform, obclavate, botuliform, reniform and various irregular shapes (Fig. 3); sometimes 1-2 vacuoles present in immature sporangia; separated from the sporangiophore by a septum; smooth, non-papillate

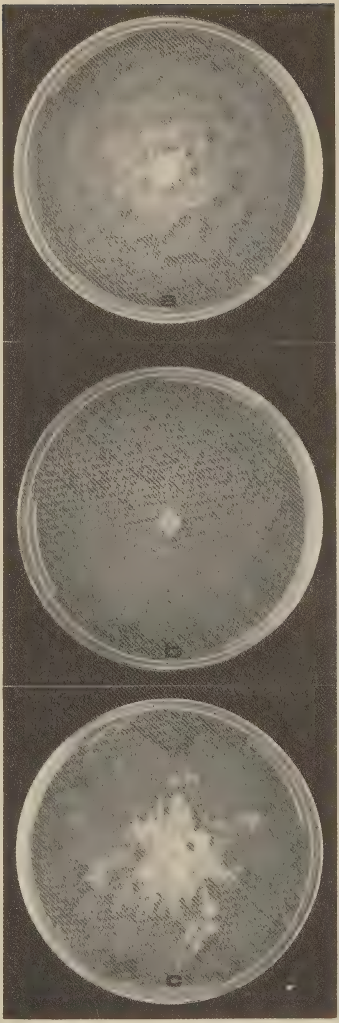

Figure 1.
16 day old cultures on 2% V-8 distilled water agar.
a. *Phytophthora avicennae*
b. *Phytophthora batemanensis*
c. *Phytophthora polymorphica*

(shrinkage of protoplasm away from apex just prior to zoospore differentiation can give impression of papilla), apex rounded (occasionally tapering); not deciduous; non-pedicillate; 44-121 x 18-44 μm ($\bar{x}$ = 75x31 μm), length/breadth ratio 1.6-4.8 ($\bar{x}$ = 2.6), exit pore 6-13 μm

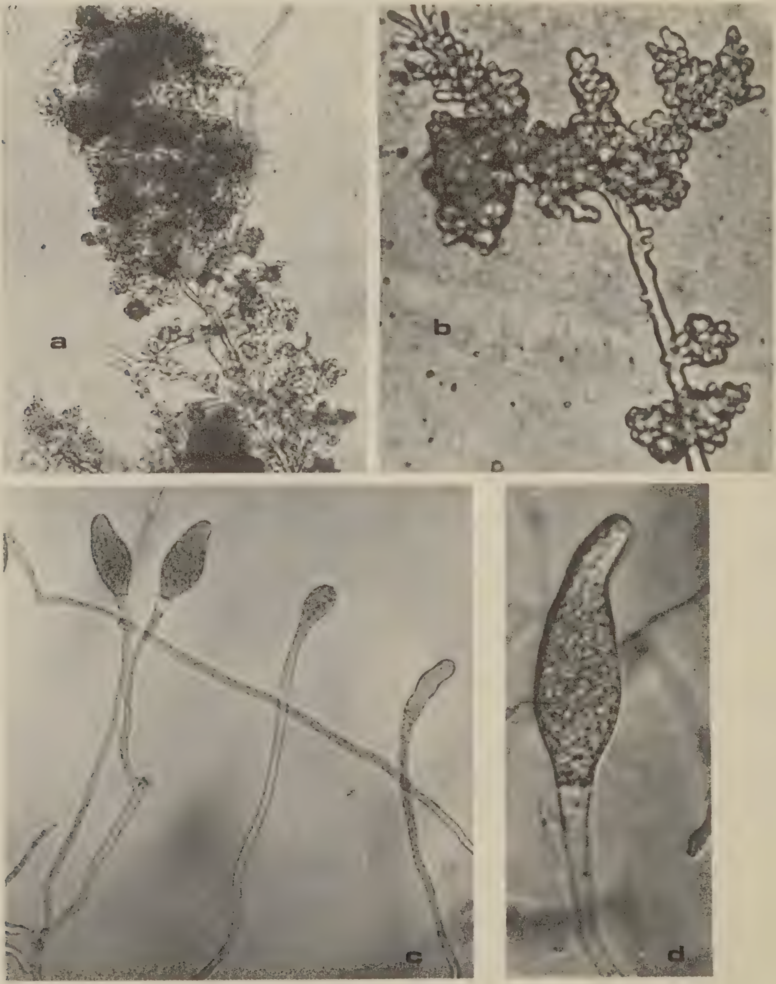

Figure 2. *Phytophthora avicennae*. a-b. Clusters of coralloid hyphae (a x190, b x560). c-d Sporangiophores and sporangia on 2% V-8 distilled water agar (c x275; d x600).

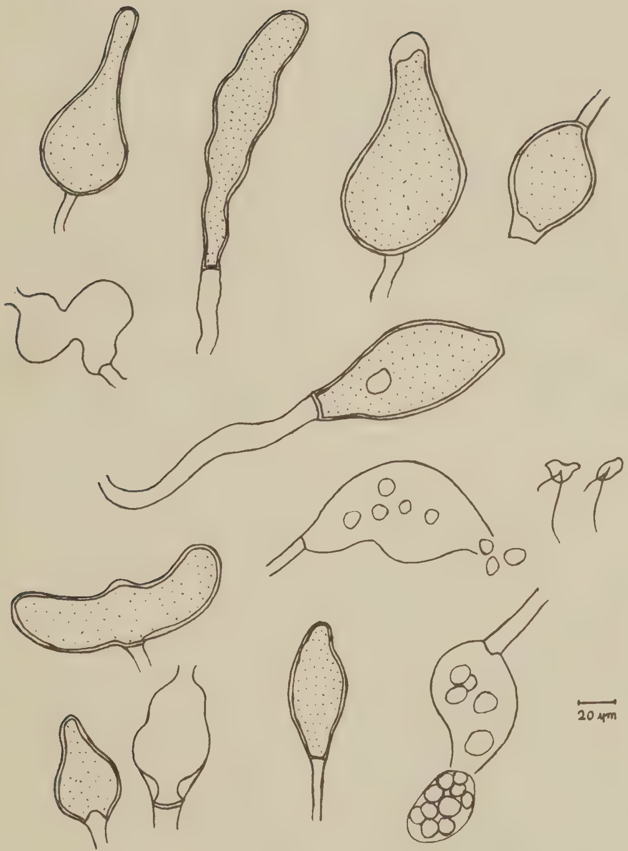

Figure 3. *Phytophthora avicennae*. Drawings showing variation in sporangium shape.

(x̄ = 10 µm) diameter. Sporangial germination was mainly by vesicle (Fig. 4a-d), occasionally by direct release of zoospores. Vesicle sessile, globose or ovoid, persistent, apically rupturing by 1-2 pores to release zoospores one by one. Internal proliferation not seen.

Zoospores released within 20-30 seconds of migration into the vesicle; reniform to elliptical or irregularly elongated; centrally biflagellate, ca 7-12 x 6-8 µm (x̄ = 8 x 7 µm), germination usually by one germ tube; one flagellum 21-27 µm long, the other 8-10 µm long.

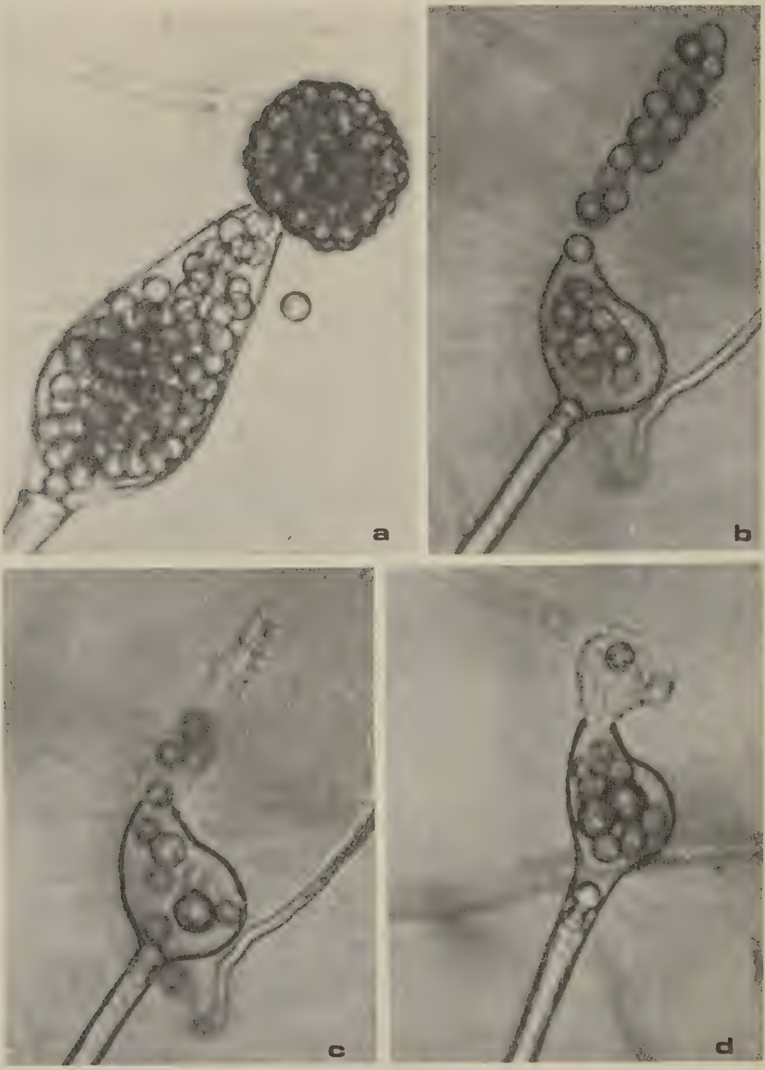

Figure 4. *Phytophthora avicennae*. Zoospore release from sporangia on 2% V-8 distilled water agar plates flooded with seawater. a, b. Zoospores differentiated in sporangium then move into vesicle (a x 635; b x 625). c. Cylindric vesicle after most of the zoospores have been discharged (c x635) d. Collapsed vesicle (d x640).

Oogonia not formed alone or in combination with A1 and A2 isolates of *P. palmivora*, *P. nicotianae var. parasitica* or *P. cinnamomi*.

Holotype: an estuarine aquatic fungus from fallen yellow leaves of *Avicennia marina* var. *australasica* from Bateman's Bay, New South Wales, J. Simpson, 23.II.1982.

Other isolates were obtained from *A. marina* leaves from Gosford, J. Simpson, 12.VIII.1982, and from *Aegiceras corniculatum* (L.) Blanco leaves from Lane Cove, N.S.W., J. Simpson, 16.IX.1982.

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P. avicennae differs from *P. vesiculosa* Anastasiou & Churchland, which it closely resembles, as the latter species has a unique, semipersistent vesicle forming an exit tube by the inversion of an internal plug (Anastasiou & Churchland, 1969; Fell & Master, 1975). According to those authors isolates of *P. vesiculosa* may also form oogonia on sesame seeds or agar blocks submerged in seawater at room temperature. *P. avicennae* forms large clusters of coralloid hyphae which have not been reported in *P. vesiculosa*.

2. *Phytophthora batemanensis* Gerrettson-Cornell & Simpson sp. nov.

Summum mycelium pauperum vel absens. Hyphae hyalinae, ramosae, teretes, demum raro septatae, 5-7 µm diam. *Chlamydosporae* non exhibitae. *Sporangiophora* a hyphis non distincta, non ramosa, non torsiva, 3-7 µm diam., sympodialia. *Sporangia* teretes, in agaro sub aqua marina solum producta, globosa demum ovata, non papillata, non caduca, non pedicillata, apice protrudente, 33-96 x 26-81 µm ($\bar{x}$ = 64x48 µm). *Zoosporae* in sporangio effectae ad vesiculam aliquando migrantes, reniformes aliisque formis, uno tubo germinale germinantes, 7-12 x 6-8 µm ($\bar{x}$ = 8x7 µm) centraliter biflagellatae. *Reproductio sexualis* ignota.

Holotypus: Cultura sicca et luminae vitreae ex foliis putrescentibus *Avicenniae* sp., Bateman's Bay, New South Wales, J. Simpson, 23.II.1982, DAR 41559 - Department of Agriculture - Rydalmere, N.S.W.

Cultures on V-8 agar and CMA petalloid; aerial mycelium practically non-existent, hyphae submerged (Fig. 1b). Growth rates after 6 days at 25°C on corn meal agar and V-8 agar, 11 and 45 mm diameter respectively. No growth on PDA.

Hyphae branched, smooth, 5-7 μm diameter, coenocytic, occasionally septate in old cultures. Side branches often very short (10-20 μm) and tapering, more abundant in CMA than V-8 agar. Swellings not formed. Some hyphal aggregates observed, especially near the inoculum.

Chlamydospores not formed.

Sporangiophores not erect, up to 300-500 μm in length, 3-7 μm diameter, smooth, subhyaline, simple, rarely sympodially branched at ca 15-20 μm below the base of the previously formed sporangium.

Sporangia formed abundantly on V-8 agar flooded with sea water. Subhyaline to pale grey or greyish brownish; terminal; smooth; globose when young becoming broadly elliptical to limoniform, separated from sporangiophore by a septum 2-7 μm below base of sporangium; non-papillate (shrinkage of protoplasm away from apex just prior to zoospores differentiation can give impression of papilla); not deciduous; non-pedicillate; with a round apex becoming protuberant (up to 16 μm)and apically round or flat (Fig. 5a-b; Fig. 6); 33-96 x 26-81 μm ($\bar{x}$ = 64x48 μm), length/breadth ratio 1.1-1.6 ($\bar{x}$ = 1.3), exit pore 7-15 μm ($\bar{x}$ = 9 μm) diameter. Sporangial germination either by direct release of zoospores or by vesicle (Fig. 5c), or by release of the whole sporangial content which breaks into single zoospores immediately or minutes later. The vesicle, when formed, was elongated, sessile, persistent, apically

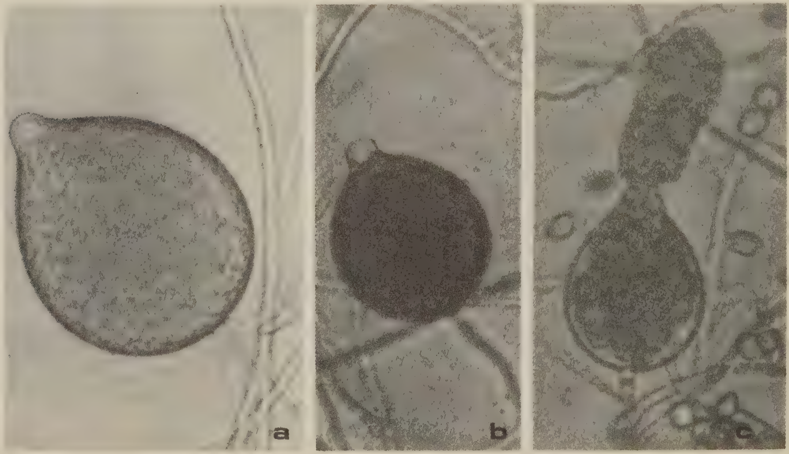

Figure 5. *Phytopthora batemanensis*, a-b. Typical sporangia showing extroflexed, non-papillate apex (a x540; b x640) c: sporangium and vesicle (x640).

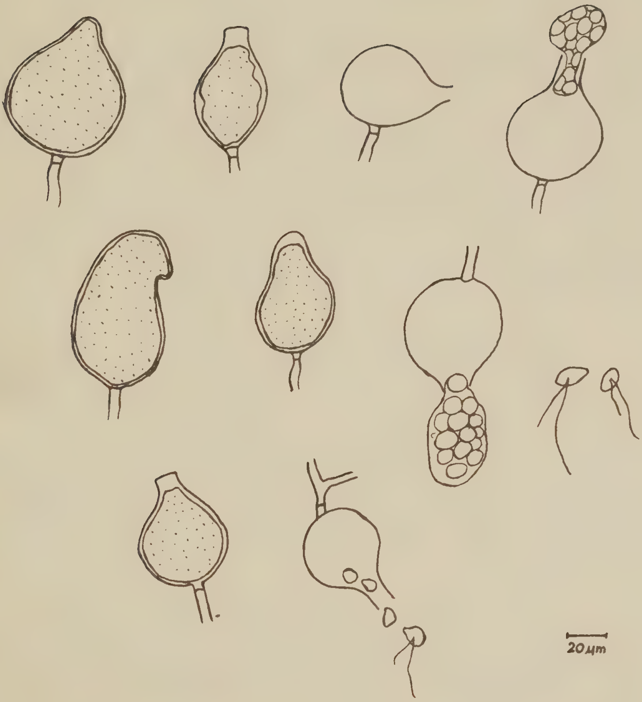

Figure 6. *Phytophthora batemanensis*. Drawings of sporangia and of zoospore release.

rupturing to release zoospores. Internal proliferation not observed.

Zoospores reniform to irregularly elongated; centrally biflagellate, ca 14-17 x 5-8 µm ($\bar{x}$ = 9x7 µm), germinating by a single germ tube; one flagellum 40-48 µm long, the other 30-35 µm long. *Oogonia* not formed alone or in combination with A1 or A2 isolates of *P. palmivora, P. nicotianae var. parasitica* or *P. cinnamomi*.

Holotype: Dried culture and microscope slides DAR 41559 of an estuarine aquatic fungus from fallen yellow leaves of *Avicennia marina* var. *australasica* Bateman's Bay, N.S.W., J. Simpson, 23.II.1982.

Other isolates were obtained from *A. marina* leaves from Gosford N.S.W., J. Simpson, 12.VIII.1982.

3. *Phytophthora polymorphica* Gerrettson-Cornell & Simpson sp. nov.

Summum mycelium pauperum, album. *Hyphae* hyalinae, ramosae, teretes, demum septatae, 5-7 mm diam. *Chlamydosporae* non exhibitae. *Sporangiophora* non ramosa, non torsiva, 5-7 µm diam., sympodialia. *Sporangia* teretes, in agaro sub aqua marina producta, plures formas habent, non papillata, non caduca, non pedicillata, apice aliquando protrudente, 44-102 x 33-84 µm ($\bar{x}$ = 72x58 µm). Hypha prominens, a sporangio lateraliter aliquando orta, usque 30 µm longa, ab apice sporangii distincta. *Zoosporae* in sporangio effectae, ad vesiculam aliquando migrantes, centraliter biflagellatae, 12-17 x 5-7 µm ($\bar{x}$ = 14x6-7 µm). *Reproductio sexualis* ignota.

Holotypus: Cultura sicca et laminae vitreae ex foliis putrescentibus *Eucalypti* sp., Bateman's Bay, New South Wales, J. Simpson, 23.II.1982, DAR 41562 - Department of Agriculture - Rydalmere, New South Wales.

Cultures on V-8 agar petalloid, aerial mycelium scanty, white especially round the inoculum (Fig. 1c); on CMA colonies radiate, with a polygonal outline, mycelium entirely submerged. Growth rates after 6 days at 25°C on CMA and V-8 agar, 33 and 51 mm respectively. No growth on PDA.

Hyphae branched, smooth, 5-8 µm diameter, coenocytic becoming septate in age. Short, lateral branch hyphae and coralloid hyphae observed on both CMA and V-8 agar. Swellings not formed. Some hyphal aggregates observed on V-8 agar.

Chlamydospores not formed.

Sporangiophores not erect, up to 400 µm long, 5-7 µm wide, smooth, sybhyaline. Branching seldom observed, sympodial at ca 2-20 µm from the base of the previously formed sporangium.

Sporangia formed abundantly, sparsely or in groups of 3-15 on V-8 agar submerged under sea water. Subhyaline to greyish or pale brown; terminal; smooth; globose when young, sometimes with 1-3 vacuoles, then ovate, obpyriform and many other different shapes including some with two apices (but only one discharge pore) and some very irregular (Fig. 7; 8a-c) (marked polymorphism); some sporangia producing a hyphal projection (Fig. 8d), up to 30 µm long, distinct from discharge pore; separated from the sporangiophore by a septum 4-5 µm below the sporangium; non-papillate (shrinkage of protoplasm away from apex just prior to zoospores differentiation can give impression of papilla); not deciduous; non-pedicillate; with a round apex becoming protuberant and apically flat; 44-102 x

33-84 µm ($\bar{x}$ = 72x58 µm) length/breadth ratio 1.0-1.6 ($\bar{x}$ = 1.3); exit pore 7-12 µm ($\bar{x}$ = 10 µm) wide. Sporangial germination either by direct release of zoospores through the exit pore or by vesicle or by release of the whole sporangial content which breaks into single zoospores immediately after discharge. Vesicle sessile, persistent, apically rupturing to release zoospores. Internal proliferation not observed.

Zoospores irregularly elongated; centrally biflagellate, 12-17 x 5-7 µm ($\bar{x}$ = 14x6-7 µm); flagella 16-30 and 10-15 µm long respectively.

Oogonia not formed alone or in combination with A1 or A2 isolates of *P. palmivora, P. nicotianae var. parasitica* or *P. cinnamomi*.

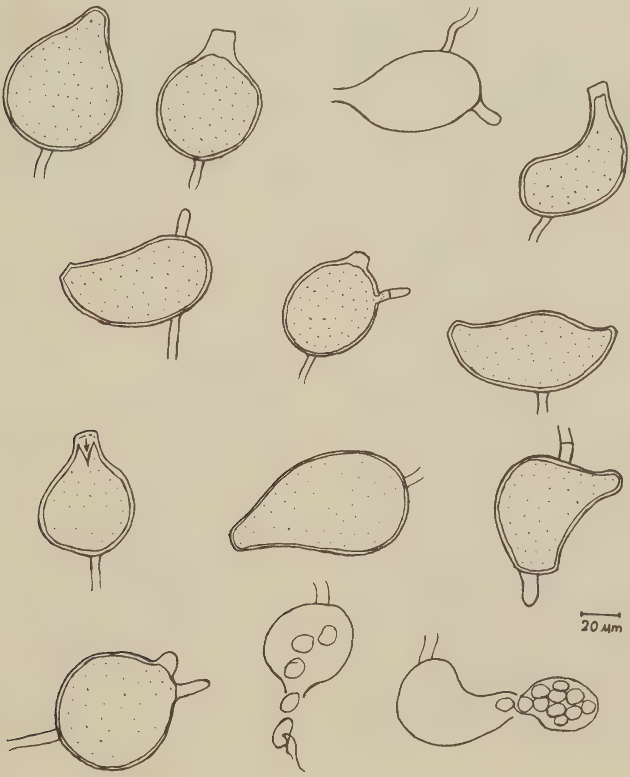

Figure 7. *Phytophthora polymorphica*. Drawings of sporangia.

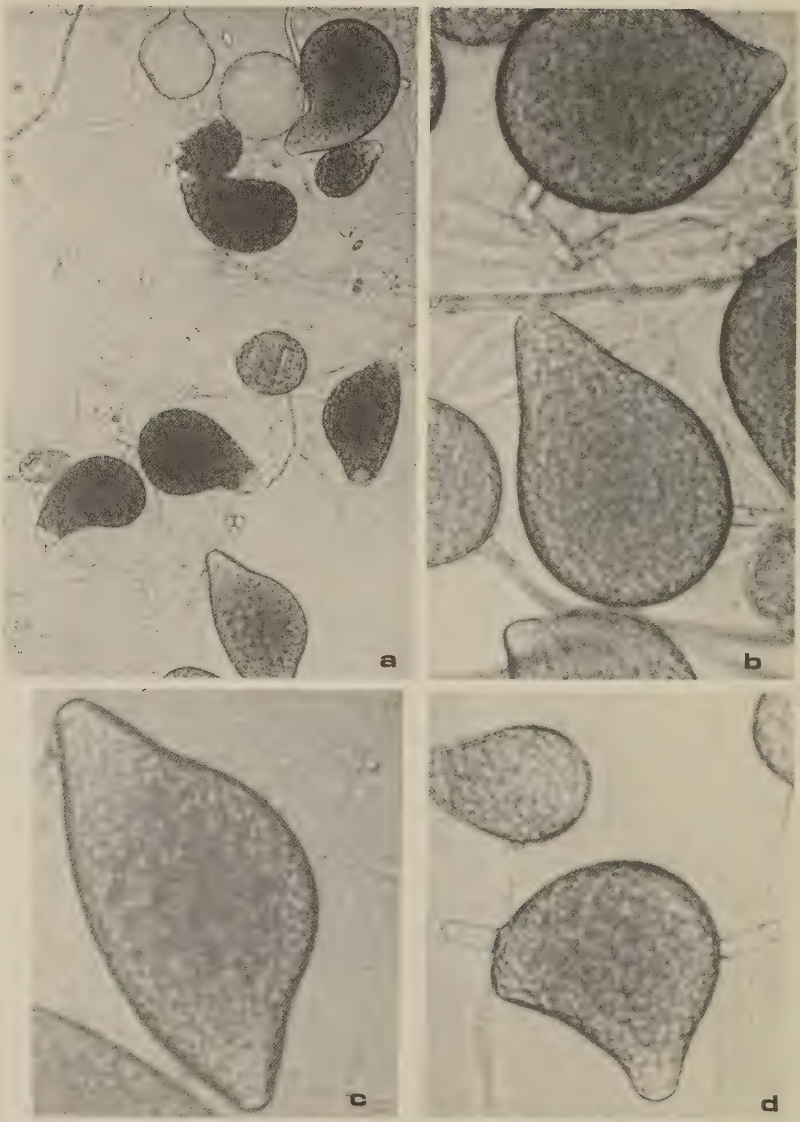

Figure 8. *Phytophthora polymorphica.* a-c Sporangia. d Sporangium showing lateral process (a x230; b x545; c x550; d x540).

Holotype: Dried cultures and microscope slides of an estuarine aquatic fungus from fallen yellow leaves of *Eucalyptus* sp., Bateman's Bay, N.S.W., J. Simpson, 23.II.1982.

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P. polymorphica has some similarity to *P. bahamensis* Fell & Master (1975) which also has polymorphic sporangia, often with one or more septate or aseptate setiform appendages up to 102 µm long, and only one dehiscence tube even in multilobed sporangia. However, *P. polymorphica* does not have setiform appendages or a dehiscence tube, and often produces a persistent vesicle.

DISCUSSION

The three species described in this paper have been placed in the genus *Phytophthora* though they differ from all species in Waterhouse (1970) and Ho (1981) for the following reasons:

(i) although zoospore discharge was usually from a vesicle, differentiation of zoospores occurred exclusively within the sporangium;

(ii) zoospores were sometimes released fully flagellated directly from the sporangium;

(iii) the vesicle, when formed, was sessile and not evanescent;

(iv) the sporangia are limoniform, obpyriform, or ovoid and show marked sporangial polymorphism, characters not typical of the majority of *Pythium* spp.;

(v) the morphology of the hyphae and the kind of colony growth, either coralloid or petalloid, and

(vi) the generally slow growth rates, are more typical of *Phytophthora* than *Pythium*.

We believe that the above combination of characters clearly place our species in *Phytophthora*. Waterhouse (1973) has discussed the position of *Phytophthora* relative to *Pythium*. The basic difference is, as emphasised by Waterhouse (1973), that in *Phytophthora* the sporangial protoplasm is fashioned into zoospores before emission or nearly so, while in *Pythium* sporangial protoplasm emerges almost or completely undifferentiated into a vesicle before differentiation and emission.

Hohnk (1953, 1956) reported isolating species of *Pythium* and *Pythiogeton* from seawater and saline lake sediments but not species of *Phytophthora*. Later

Anastasiou & Churchland (1968), and Fell & Master (1975) reported that species of *Phytophthora* were prevalent in saline waters in estuaries and mangrove ecosystems. It was suggested that *Phytophthora* spp. were an important component of mangrove litter degradation systems throughout the tropics. From mangrove ecosystems in tropical Australia three species of *Phytophthora* have been reported: an undescribed species near *P. vesiculosa* from rootlets and trunk cankers of *A. marina* (Pegg *et al.*, 1980); *P. operculata* Pegg & Alcorn from decayed *A. marina* leaves (Pegg & Alcorn, 1982); and *P. nicotianae* var. *nicotianae* from roots of *A. marina* (Weste *et al.*, 1982). None of these species was isolated from the Clyde River estuary. However, the species described by us do have some similarities to *P. vesiculosa*. The differences are highlighted in the key. This has been prepared from descriptions given in the published literature.

KEY TO SPECIES OF MARINE PYTHIACEAE

A.	Zoospores differentiation occurs outside the sporangium in an evanescent vesicle.	*Pythium* spp.	B
A^1.	Zoospores differentiation occurs inside the sporangium, though zoospores may be discharged through a vesicle	*Phytophthora* spp.	H
B.	Sporangia filamentous, or lobulate and irregular.		C
B^1.	Sporangia spherical, ovoid, or bursiform-ventricose.		G
C.	Anteridia and oogonia produced; homothallic species.		D
C^1.	Anteridia and oogonia lacking.		F
D.	Sporangia lobulate.	*Pythium aquatile* Hohnk	
D^1.	Sporangia filamentous.		E
E.	Anteridial branches monoclinous.	*Pythium maritimum* Hohnk	
E^1.	Anteridial branches diclinous.	*Pythium marinum* Sparrow	
F.	Hyphae 2-4 μm diameter; sporangia lobulate or filamentous.	*Pythium imperfectum* Hohnk	

F^1.	Hyphae 5-20 µm diameter; sporangia filamentous.	*Pythium thalassium* D. Atkins	
G.	Sporangia spherical or ovoid, 8-24 µm long; oogonia 10-19 µm diameter.	*Pythium salinum* Hohnk	
G^1.	Sporangia bursiform-ventricose, 35-131 µm long; oogonia 36-45 µm diameter.	*Pythium grandisporangium* Fell & Master	
H.	Antheridia and oogonia produced in single culture; homothallic; anteridia paragynous, oogonia 32-60 µm.	*Phytophthora vesiculosa* Anastasiou & Churchland	
H^1.	Antheridia and oogonia not produced in single culture.		I
I.	Sporangia with prominent spines; not forming a vesicle.		J
I^1.	Sporangia without prominent spines; sometimes a hollow lateral process present; vesicle present or absent.		L
J.	Sporangial surface denticulate with spines 1-4 µm high clustered in small irregular groups.	*Phytophthora mycoparasitica* Fell & Master	
J^1.	Sporangial surface spiny, spines 11-29 x 3-6 µm.		K
K.	Sporangia globose, ovate or obovate, 60-107 µm diameter.	*Phytophthora spinosa* var. *spinosa* Fell & Master	
K^1.	Sporangia obpyriform, auriculate or botryose, 56-150 µm diameter.	*Phytophthora spinosa* var. *lobata* Fell & Master	
L.	Sporangium opening by an operculum; vesicle not formed.	*Phytophthora operculata* Pegg & Alcorn	
L^1.	Sporangium not opening by an operculum; vesicle present or absent.		M
M.	Sporangia non-deciduous, with a short congenital dehiscence		O

	tube and a cylindrical dehiscence plug; vesicle not formed.		
M^1.	At least some sporangia discharging zoospores from a vesicle.		O
N.	Sporangia bursiform, obpyriform, to obclavate with one dehiscence tube, 26-119 x 14-43 µm; dehiscence tube 3-7 µm long; dehiscence plug evanescent.	*Phytophthora bahamensis* Fell & Master	
N^1.	Sporangia lageniform to obpyriform, 43-184 x 56-107 µm with an elongate dehiscence tube 10-51 µm long; dehiscence plug persistent.	*Phytophthora epistomium* Fell & Master	
O.	Sporangiophores usually branching sympodially from base of previously formed sporangium.		P
O^1.	Sporangiophores rarely branched.		Q
P.	Hyphae 1.1-3.4 µm diam., tuberous or reniform swellings common in culture; sporangia papillate.	*Phytophthora vesiculosa* Anastasiou & Churchland	
P^1.	Hyphae 5-9 µm diam., hyphal swellings not present in culture; sporangia not papillate, abundant on surface of V-8 agar plates.	*Phytophthora avicennae* Gerrettson-Cornell & Simpson	
Q.	Sporangia broadly elliptical to limoniform, smooth.	*Phytophthora batemanensis* Gerrettson-Cornell & Simpson	
Q^1.	Sporangia polymorphic, frequently with a hollow lateral process.	*Phytophthora polymorphica* Gerrettson-Cornell & Simpson	

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BIBLIOGRAPHY

Anastasiou, C.J., & Churchland, L.M. (1969). Fungi on decaying leaves in marine habitats. Canadian Journal of Botany 47: 251-257.

Clarke, L.D., & Hanson, N.J. (1970). The mangrove and salt marsh communities of the Sydney district. III. Plant growth in relation to salinity and waterlogging. *Journal of Ecology* 58: 351-369.

Fell, J.W. & Master, I.M. (1975). Phycomycetes (*Phytophthora* spp. nov. and *Fythium* sp. nov.) associated with degrading mangrove (*Rhizophora mangle*) leaves. Canadian Journal of Botany, 53: 2908-2922.

Gerrettson-Cornell, L. (1980). Notes on the morphology of some isolates of *Phytophthora* from Australia. *Cryptogamie-Mycologie* 1: 139-154.

Gill, A.M. (1975). Australia's mangrove enclaves: A coastal resource. *Proceedings of the Ecological Society of Australia* 8: 129-146.

Ho, H.H. (1981). Synoptic keys to the species of *Phytophthora*. *Mycologia* 73: 705-714.

Hohnk, W. (1953). Studien zur brack - und seewasser-mykologie III. Oomycetes: Sweiter Teil. Veroffentlichungen, Instituts fur Meeresforschung, Bremerhaven 2: 52-108. (Cited by Johnson & Sparrow, 1970).

Hohnk, W. (1956). Studien zur brack - und seewasser-mykologie VI. Uber die pilzliche bespedlung verschieden salziger submerger standorte. *Veroffentlichungen des Instituts fur Meeresforschung, Bremerhaven* 4: 67-110.

Johnson, T.W. & Sparrow, F.K. Jr. (1970). Fungi in oceans and estuaries. *Bibliotheca Mycologia* 26: 1-668.

Macnae, W. (1966). Mangroves in eastern and southern Australia. *Australian Journal of Botany* 14: 67-104.

Pegg, K.G., Gillespie, N.G. and Forsberg, F.I. (1980). *Phytophthora* sp. associated with mangrove death in Central Coastal Queensland. *Australian Plant Pathology Society Newsletter* 9: 6-7.

Pegg, K.G. and Alcorn, J.L. (1982). *Phytophthora operculata* sp. nov., a new marine fungus. *Mycotaxon* 16: 99-102.

Waterhouse, G.M. (1970). The genus *Phytophthora* de Bary (2nd ed.). *C.M.I. Mycological Paper* 122: 1-59.

Waterhouse, G.M. (1973). *Peronosporales*. Pp. 165-183. In: The Fungi, an advanced treatise. Vol. IVB. Eds., G. C. Ainsworth and A. S. Sussman, Academic Press, New York.

Weste, G., Cahill, D. and Stamps, D.J. (1982). Mangrove dieback in North Queensland, Australia. *Transactions British Mycological Society*. 79: 165-167.

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A NEW PILEATE SPECIES OF JUNGHUHNIA (POLYPORACEAE)[1]

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SUMMARY

Junghuhnia complicata n. sp. is described from Argentina. It is characterized by a resupinate to truly pileate fruitbody, a dimitic hyphal system, long apically encrusted cystidia and small, subglobose, hyaline basidiospores.

METHODS

Microscopic examination of basidiocarps were made from free-hand sections mounted in 5% KOH aqueous phloxine, in Melzer's reagent (Singer, 1949: 80) and in .5% cotton blue in 25% lactophenol. Drawings were made with a camera lucida. Herbarium abbreviations are from Holmgren & Keuken (1974). Cultures were obtained from sporophore tissue and from spore prints, and were grown, studied and described according to Nobles (1948, 1965), the plates maintained in the dark at 25°C. Species code describe 6 weeks old cultures. Oxidase reactions were tested in .5% (w/v) gallic acid agar (GAA) and .5% (w/v) tannic acid agar (TAA) Davidson et al. 1938: 684), recording the quality of reactions at 7 days. Alcohol solution of gum guaiac (GG) was used to determine rapidly the presence of oxidases in culture, as described by Nobles (1958). Cultures are deposited in the Laboratorio de Micología at the authors' address (BAFC cultures).

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1. Research subsidized by grants from the Instituto Forestal Nacional, Alto Paraná S. A., and the Consejo Nacional de Investigaciones Científicas y Técnicas, Argentina.
2. Member of the "carrera del personal de apoyo a la Investigación y Desarrollo" of the above Consejo.
3. Principal reseracher of the "carrera del investigador científico" of the above Consejo.

Description of basidiocarps

JUNGHUHNIA COMPLICATA n. sp. (Figs. 1-18)

Basidiocarpus annuus, resupinatus vel effuso-reflexus, dimidiatus vel ad substrato late adhaerens, dense imbricatus vel solitarius, 1-6 x 0.5-3 x 0.1-o.2 cm. Superficie pilei glabra, concentrice sulcata, azonata, in vivo alba, in sicco cremeofulva. Contextus suberosus, ochraceus, tenuissimus. Pori 4-6 per mm, rot3ndati vel angulari, in zonae resupinatae elongati daedaliformibusque. Systema hypharum dimiticus: hyphae generaritivis fibulatis tenui vel crassitunicatis, hyphae skeletibus crassitunicatis. Cystidia elongata apicibus incrustatis. Basidiosporis late ellipsoideis vel subglobosis, laevibus, hyalinis, 3.6-4.6 x 3.1-3.6 um, inamyloideis, acyanophilis. Putrefactione ligno alba.

Holotypus: Argentina, Misiones, Puerto Libertad, ad cultura arborum coniferarum Alto Paraná, leg. S. Blumenfeld, 25.III.1981, ad Pinus taeda vivo, in Herb. BAFC n° 28947 conservatus est.

Fruitbody annual, pileate, resupinate to effuse-reflexed or truly dimidiate, very thin, flexible and light-weight, generally imbricate, rarely single, 1-6 x .5-3 x .1-.2 cm (Fig. 13). Pileus pure white when fresh, cream to ochraceus (Maerz & Paul, Plate 10 4 E) when dry, glabrous, azonate, surface even or with sulcate zones; margin thin, smooth to corrugated. Pore surface light cream, pores round to angular, 4-6 per mm, becoming elongated and sinuous in resupinate parts of the fruitbody and appearing daedaloid (Fig. 14); tubes up to 1 mm long, concolorous with the pore surface. Context very thin, fibrous-corky, light ochraceus, up to 1 mm thick.

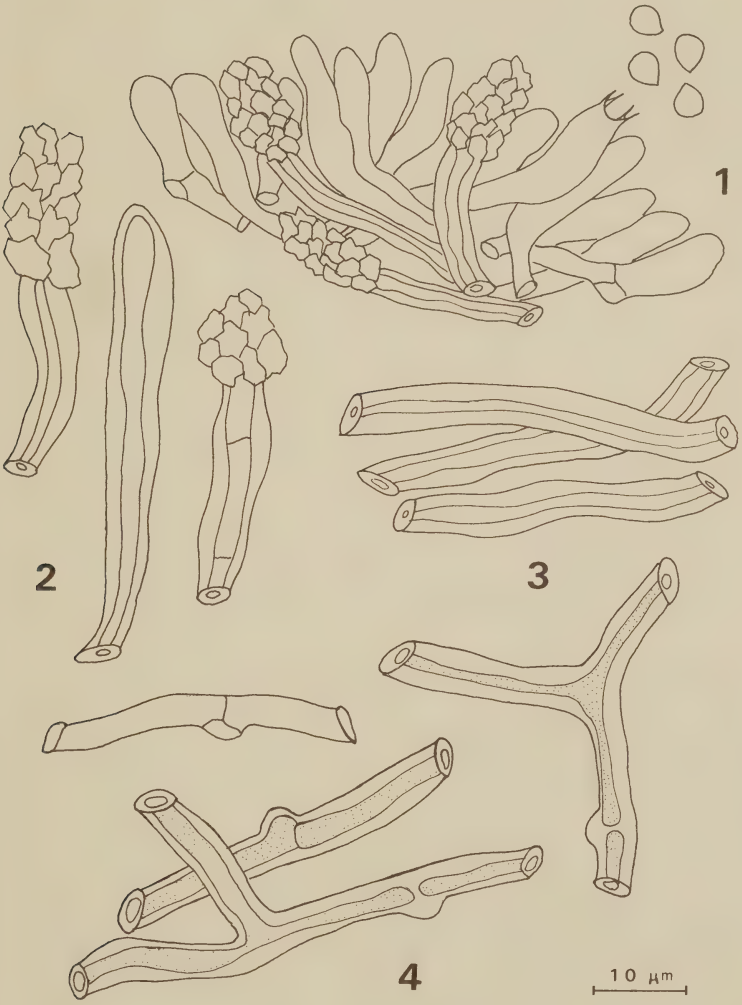
Hyphal system dimitic. Generative hyphae with clamps, thin- to thick-walled, 2-5.7 µm wide (Fig. 4); skeletal hyphae thick-walled to almost solid, 3-5.7 µm wide (Fig. 3). Hymenium 13-27 µm thick (Fig. 1). Basidia claviform, 10-15 x 6-8 µm, tetraspored, sterigmata up to 3 µm long. Basidiospores broadly ellipsoid to subglobose, smooth, hyaline, thin-walled, 3.6-4.6 x 3.1-3.6 µm, inamyloid, acyanophilous. Cystidia (Fig. 2) numerous to scattered, thick-walled, cylindrical but broader towards the apex which is normally encrusted with crystals that slowly dissolve in 5% KOH solution, 4-7.8 µm wide, embedded in the trama or projecting above the hymenium.

Habitat - on living trees and stacked log segments of Pinus elliottii Engelm. and P. taeda L; on dead wood of Allophyllus edulis (St. Hila.)Radlk., a hardwood species. Associated with a white rot.

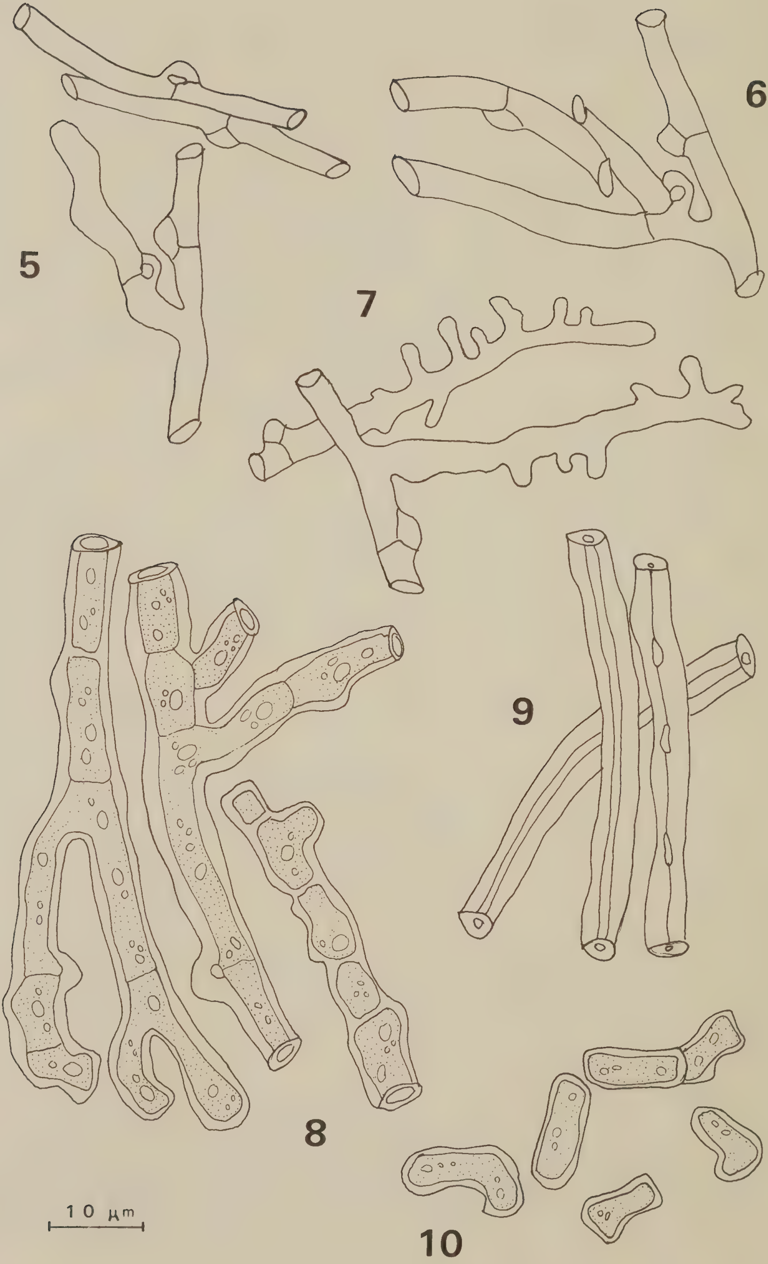
Distribution: Argentina, provinces of Buenos Aires and Misiones.

Representative specimens: BUENOS AIRES: Campana, INTA Delta, leg. Blumenfeld, 24.VI.1981, on P. taeda (BAFC 28944); ibid., leg. ipse 21.III.1981, on P. taeda (BAFC 28949); ibid ., leg. ipse, III.1982,on P. elliottii (BAFC 28945); Punta Lara, leg. Deschamps, 14.VII.76 on A. edulis (BAFC 24116). CAPITAL FEDERAL: Virrey del Pino, leg. Bruno 10.X. 1978, on Pinus sp. (BAFC 28324). MISIONES: Puerto Libertad, leg. Blumenfeld 21.XII.1980, on P. taeda (BAFC 28946); ibid., leg. ipse, 25.

III.1981, on *P. taeda* (BAFC 28947,HOLOTYPE); ibid., leg. ipse, VI.1980 on *P. elliottii* (BAFC 28949, 28950); ibid., leg. Cabral & López, 20.IX. 1979 on P. taeda (BAFC 24468).



Figs. 1-4. Microscopic characters of the basidiocarps of *Junghuhnia complicata*. 1: hymenium and basidiospores; 2: cystidia before and after immersion in KOH solution; 3: skeletal hyphae; 4: generative hyphae.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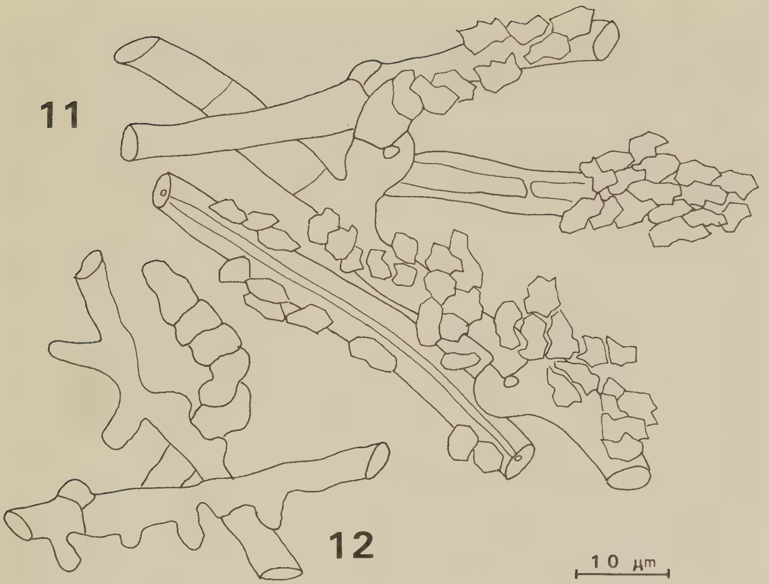
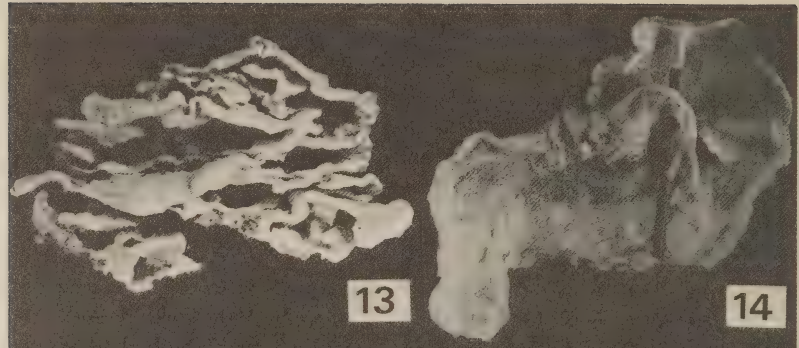
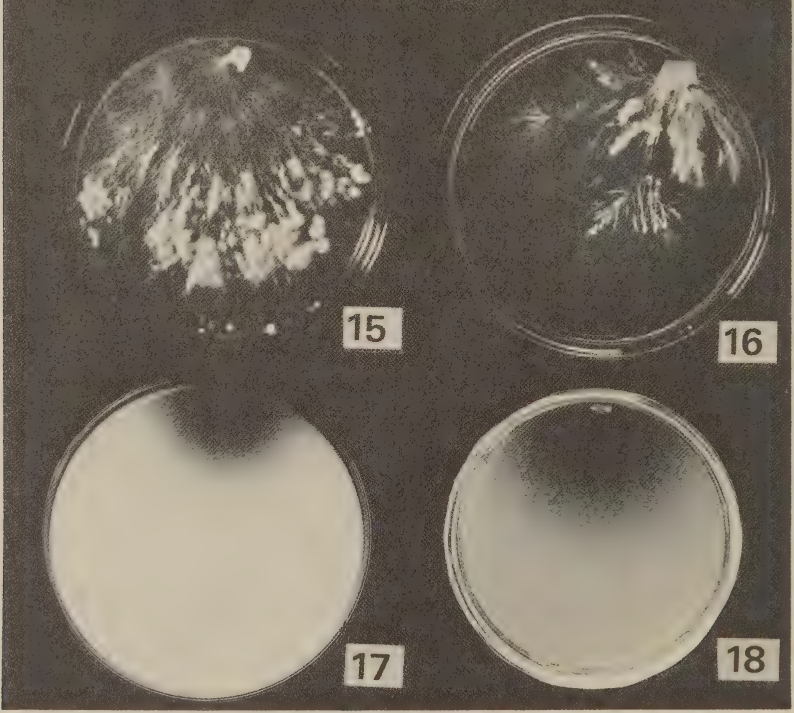


Figs. 5-12. Microscopic cultural features of *Junghuhnia complicata*. 5: generative hyphae from the margin; 6: narrow generative hyphae from the aerial mycelium; 7: generative hyphae with numerous short branches. 8: wide generative hyphae with vacuolar contents; 9: skeletal hyphae from the aerial mycelium; 10: arhtrospores; 11: encrusted hyphae from the felty aerial mycelium; 12: hyphae from the submerged mycelium.

REMARKS: No pileate species have been previously described in *Junghuhunia* Corda. However, the dimitic hyphal system, the apically encrusted cystidia and the white rot warrant the inclusion of this species in the genus as defin= ed by Ryvarden (1972: 18). A sterile pileate specimen was, however, reported by Ryvarden (1980: 391) from East Africa. The present species may also be related to *Flaviporus* Murr., which is characterized by Ginns (1980: 1578-1579) as a genus with "small and thin basidiomes, context when dry hard, woody to horny. Our species has neither the typically agglutinated hyphae nor basidiomes with a horny consistency. The cultural characters of this species (see below) are similar to those of other species of *Junghuhnia* (see Lombard & Gilbertson, 1966, and Stalpers 1978: 63, 96).

Junghuhnia complicata was frequently found during a study on fungal damage in plantations of Pinus elliottii and P. taeda. However, it was never recorded before in this area where the fungal floras have been rather intensevile studied. Furthermore, it is mostly found on Pinus since among fifty collections only one was found on another substrate (Allophyllus edulis).





Figs. 13-14. Macroscopic characters of the basidiocarps of *Junghuhnia complicata*. 13: imbricate fruitbodies; 14: Pore surface.

Figs. 15-18. Macroscopic aspect (x 0.6) of mats in culture. 15: 2453 (BAFC 28949) at 2 weeks; 16: 2438 (BAFC 28946) at 6 weeks; 17: oxidase reaction on TAA (BAFC 2438); 18: oxidase reaction on GAA (BAFC 2438).

DESCRIPTION OF CULTURES

Cultures studied = 2302 (BAFC 28944); 2438 (BAFC 28946); 2444 (BAFC 28947, from the holotype); 2453 (BAFC 28949).

Species code: 2. 3. 8. (35). 36. 38. 43. 53. 55. (56).

MACROSCOPIC CHARACTERS: growth moderately rapid, covering the plates in the 3rd week. Mats hyaline, very thingly subfelty, developing felty radiating lines (Fig. 15) or broad felty white areas (Fig. 16) by the 2nd week. Margin hyaline, subfelty and arachnoid. Odor none. Reverse unchanged. Oxidase reactions: on GAA = ++++, no growth (Fig. 18); on TAA = +++, no growth (Fig. 17); on GG test = +.

MICROSCOPIC CHARACTERS: marginal mycelium with hyphae staining with phloxine, clamped, branched and thin-walled, 1.5-2.6 µm (Fig. 5). Aerial mycelium formed by: a) simple, clamped, thin-walled generative hyphae, 1.5=2.6 µm (Fig. 6); b) similar to a) but with numerous short branches (Fig. 7); c) wide, clamped, thin- to thick-walled generative hypahe, up to 4.5 µm wide, with many refringent vacuoles (Fig. 8); d) thick-walled skeletal hyphae, 2.08-3.6 um wide (Fig. 9); e) arthrospores developed from the wide noticeably vacuolated hyphae (generative) (Fig. 10). After the 2nd week, from the white areas of felty mycelium there appear sparse to heavy incrustations with polyhedric crystals on both the generative and skeletal hyphae (Fig. 11). Submerged mycelia formed of distinctly twisted generative hyphae, with many short branches, 1.8-2.8 µm wide (Fig. 12).

REMARKS: Growth and microscopic features coincide with those given for other species of the genus *Junghuhnia*. In culture we observed the same wide generative hyphae that are described in the fruitbodies. The presence of arthrospores was variable; they did not appear in all dishes of the same culture.

ACKNOWLEDGEMENTS

We want to express our gratitude to Drs. M. Larsen and F. Lombard (Forest Mycology Lab., USDA, Madison) and to Dr. J. Ginn (Ottawa) for critically reviewing the manuscript and making invaluable suggestions.

REFERENCES

DAVIDSON, R. W., W. A. CAMPBELL and D. J. BLAISDELL. 1938. Differentiation of wood decay f ungi by their reactions on gallic and tannic acid medium. Jour. Agr. Res. 57 (9): 683-695.

GINNS, J. 1980. The genus *Flaviporus* Murrill,(Polyporaceae). Can. J. Bot. 58: 1578-1590.

HOLMGREN, K.P. and W. KEUKEN. 1974. Index Herbariorum. Regnum Vegetabile 92. 397 p.

LOMBARD, F. F. and R. L. GILBERTSON. 1966. *Poria luteoalba* and some related species in North America. Mycologia 58 827-845.

MAERZ, A. and M. R. PAUL. 1930. A Dictionarp of Color. McGraw Hill, New York. 207 p.

NOBLES, M. K. 1948. Studies in forest pathology. VI. Identification of cultures of wood-rotting fungi. Can. J. Res., C, 26: 281-431.

----------- 1958. A rapid test for extracellular oxidase in cultures of wood-inhabiting Hymenomycetes. Can. J. Bot. 36: 91-99.

-------------.1965. Identification of cultures of wood-inhabiting Hymenomycetes. Can. J. Bot. 43: 1097-1139.

RYVARDEN, L. 1972. A note on the genus *Junghuhnia*. Persoonia 7 17-21.

------------ and I. JOHANSEN. 1980. A preliminary polypore flora of East Africa. Fungiflora. Oslo. 636 p.

SINGER, R. 1949. The Agaricales in modern taxonomy. Lilloa 22. 832 p.

STALPERS, J. 1978. Identification of wood-inhabiting Aphyllophorales in pure culture. Stud. Mycol. n°16. 248 p.

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SANTESSONIA (LECANORALES, BUELLIACEAE) IN THE NAMIB DESERT (SOUTH WEST AFRICA)

by

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SUMMARY

Three species are recognized in the genus *Santessonia* : *S. lagunebergii* Sérusiaux & Wessels sp.nov., *S. namibensis* Hale & Vobis, and *S. sorediata* Sérusiaux & Wessels sp. nov. The genus is a member of the Buelliaceae and is endemic to the Namib desert. The lacunose cortical layer displayed by the genus is interpreted as a remarkable adaptation for the interception of fog. *Dactylospora hafellneriana* Sérusiaux sp. nov. is a new lichenicolous fungus found on *Santessonia lagunebergii*.

INTRODUCTION

In 1978 the attention of lichenologists was opportunely drawn to the coastal desert of the Namib along the west coast of South West Africa by the description of a new fruticose lichen genus, *Santessonia* Hale & Vobis. The Namib desert comprises the sandy or rocky coastal strip, some 2000 km long and mostly less than 200 km wide. It lies to the west of the Great Western Escarpment between the Olifants river (Republic of South Africa) in the south and the Carunjamba river (Angola) in the north (Ward & al. 1983).

It varies in height from sea-level to 1000 m locally. It is one of the most arid parts of the world : virtually the entire area receives less than 100 mm of rain per year and parts have received less than 10 mm in fifty per cent of the years during which records have been kept (Van Zinderen Bakker 1975; Werger 1978). The coastal fringe however experiences mist or fog on more than 120 days per year. The intercepted amount for 1958 was equivalent to 130 mm of rainfall which is more than seven times the mean annual rainfall (Nagel 1962). According to Goudie (1972), this precipitation is extremely rich in salts, e.g. 120 kg/ha/year at Swakopmund. Such a persistent and regular mist permits a very rich, and adaptively interesting, lichen development, as in similar areas elsewhere (Rundel 1978).

Several lichen collections have been made in the area, some dating back to the early days of the european presence in southern Africa. F. Welwitsch for example collected many lichens in the most northerly part of the Namib desert, the Mossamedes area. They were studied by Nylander (1868) and later by Vainio (1901); the major part of these collections are preserved in BM and LISU. German botanists earlier in this century gathered other samples, mainly near Lüderitz. Although these collections suggest a rich and diverse lichen flora and vegetation, they are scanty, inadequate and unrepresentative of the entire flora of the desert. Thus, contrary to the other two coastal deserts where on-shore fog induces an exuberant lichen development (the Atacama desert in Peru and Chile and Baja California in Mexico), the lichen flora of the Namib is very poorly known. In a survey of the lichen flora of this type of deserts, Rundel (1978) is only able to speculate about the Namib.

For several years, one of us (D.W.) has been traveling through the central part of the Namib desert (in an area from Walvisbaai northwards to the Skeleton Coast Park) and has commenced an ecological study of the lichen communities. In 1983, both of us collected intensively in the same area making large and representative gatherings of the lichens growing there. These will form the basis for a complete taxonomic survey of the lichen flora of the central Namib which we plan to complete as soon as we are able. A major objective of our foray was to search

for *Santessonia*. This proved to be highly successful as three species were collected, of which two are new to science. This paper gives descriptions of these two new taxa and adds further information on the genus that our study brought to light.
The specimens cited were analyzed by thin-layer chromatography (TLC) by means of standard methods (Culberson & Amann 1979).

THALLUS ANATOMY

The thallus anatomy of *Santessonia* is rather simple; the internal symmetry is consistently radiate in structure, even when the branches are flattened as they sometimes are in *Santessonia namibensis*. Three kinds of plectenchyma are easily distinguished :

(1) - The cortical layer (fig. 1-5) consists of loosely to strongly aggregated hyphae with many dead cells, especially towards the outer surface. In the most typical parts (e.g. not eroded by the sand-blasting winds), the cortex can be described as lacunose : the walls of the living cells as well as those of dead ones are ± thickened but not carbonized and form a reticulate network between ± spherical or isodiametric lacunae. This enlarges considerably the surface contact between the lichen and the atmosphere and ensuring a rapid and lasting hydration during the periods of fog (Larson 1981). Such an adaptative plectenchyma can thus rapidly take advantage of any formation of fog. We are not aware of any other lichen genus where such an adaptation to fog or humidity interception is reported (see Rogers 1977, Rundel 1978 and 1982 for a review on morphological adaptation to aridity), although some comparison may be made with the entirely reticulate thallus of *Ramalina menziesii*. Rundel (1974) showed that "morphological studies in that species indicate that the reticulate structure has an adaptational value in increasing water holding capacity of the thallus". As one might expect, the thallus surface of the *Santessonia* species is heavily salt- and dust-encrusted : water precipitation derived from fog is extremely rich in salt and it never rains enough to wash the salt away. Moreover, the wind always blows dust and salt particles that can accumulate on the lichen surface. Follmann (1967) and Rundel (1978) demonstrated that those hydrophilic salt crusts improve the water potential of the lichen by "forming favorable water gradient for uptake of moisture".

The cortex structure and the salt crusts on its surface therefore appear to represent the strategy adopted by the genus to survive in the harsh environment of the Namib desert. The thickness of the cortex in *Santessonia* varies from 20 to 45 µm in the three species.

(2) - The phycobiont layer (fig. 2, 5) is usually organized in ± defined glomerules containing several necrotic algal cells interspersed with living ones. In old or eroded parts of thalli, most algal cells are dead. Rather large hollows are thus present in some parts of the algal layer which may then act as an enlargment of the lacunose plectenchyma of the cortex.

(3) - The central axis (fig. 3) is composed of thick-walled hyphae which are periclinally orientated and constitutes a pachydermatous prosoplectenchyme as defined by Hale (1976). The axis is extremely dense and compact in *Santessonia lagunebergii*, *S. sorediata* and in young and cylindrical parts of *S. namibensis*. In flattened parts of *S. namibensis*, it can be much more lax and irregular as pointed out by Hale & Vobis (1978).

APOTHECIAL ANATOMY AND ONTOGENY

Apothecia are always present and usually plentiful in both *Santessonia lagunebergii* and *S. namibensis*; they are unknown in *S. sorediata*. Their ontogeny has been briefly described by Hale & Vobis (1978) and their findings are confirmed by our studies. Apothecial primordia first appear as black, irregular and

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Fig. 1-5. Cross-sections of main branch of *Santessonia lagunebergii* (Sérusiaux 5218 & Wessels, holotype, LG), mounted in lactophenol-cotton blue.
1 : the three layers are clearly seen : cortex, photobiont layer and central axis. 2 and 5 : photobiont layer ± arranged in glomerules with many dead cells. 3 : water-washed section showing the lacunose cortex and the prosoplectenchymatous central axis. 4 : detail of the lacunose cortex.

Fig. 6. Cross-section of a young soredium of *Santessonia sorediata* (Sérusiaux 5171 & Wessels, holotype, LG), mounted in lactophenol-cotton blue.

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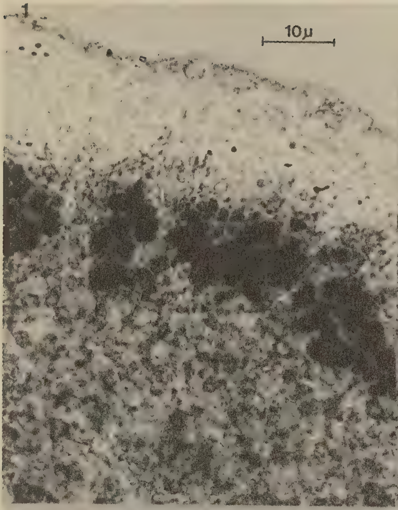

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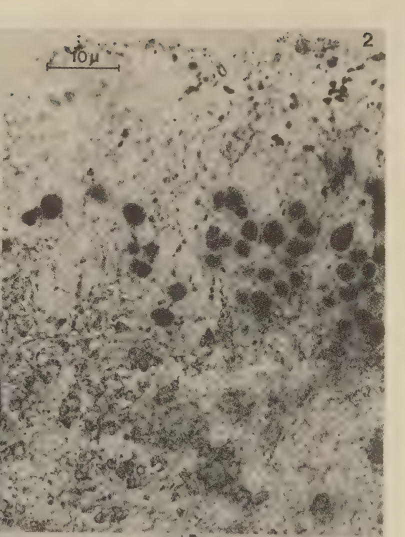

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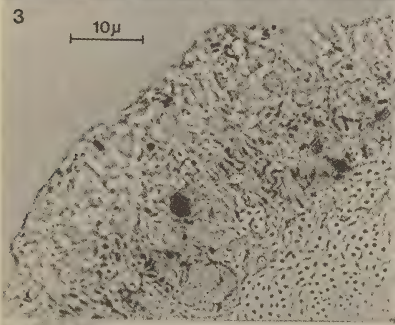

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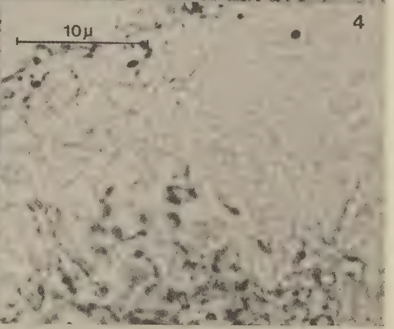

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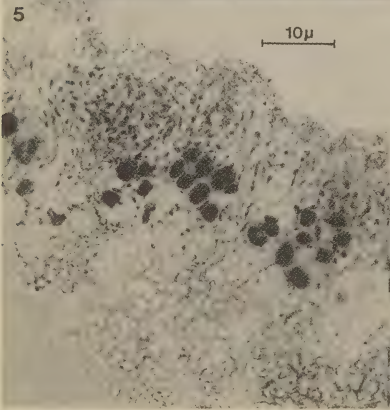

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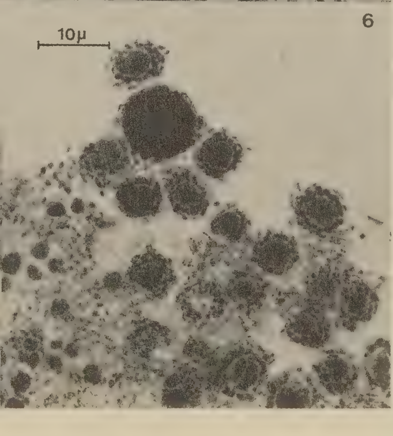

slightly raised dots on the thallus : just under the cortical layer ascogenous hyphae and trichogynes can be observed but only badly developed. The generative tissue quickly differentiates into hymenium, hypothecium and excipulum; asci are produced and ripe spores ejected very early, even before differentiation of the apothecial tissues is completed.

In *Santessonia lagunebergii*, the apothecia (fig. 7) grow laterally on the thallus branches. At first they have a flat disc and a well-developed and slightly proeminent margin soon becoming strongly convex to hemispherical as a result of the formation of a columella initiated by the lateral growth of the thallus central axis pushing into it from below. In cross-section the apothecia are very similar to those of *Pilophorus robustus* (see Jahns 1970, fig. 87.7) but the excipulum remains distinct. The columella reaches about 200-250 μm in height, then ceases growing, so that the apothecia are only slightly raised and remain close to the thallus. The columella growth also induces geniculate bending at the level of each apothecium, a phenomenon well-known in other genera (e.g. *Alectoria, Sulcaria*).

In *Santessonia namibensis*, the apothecia (fig. 21) are produced randomly (apically, laterally or even on the margins of flattened lobes). Obviously thallus growth and apothecial development appear to be badly coordinated as in some specimens, the thallus growth actually disrupts primordia. Some young apothecia consequently become elongated or split by invading vegetative tissues and stop their differentiation. The phase with flattened apothecia and a

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Fig. 7. Cross section a young apothecium of *Santessonia lagunebergii* (Sérusiaux 5218 & Wessels, holotype, LG), mounted in lactophenol-cotton blue. Note the well-developed excipulum and the growing columella.

Fig. 8-10. Cross-section of an apothecium of *Santessonia namibensis* (Sérusiaux 5219 & Wessels, LG), mounted in lactophenol-cotton blue. 8 : proliferation of the excipulum. 9 : initiation of a sterile column at epithecium level. 10 : sterile furrow within the hymenium.

Fig. 11-12. Spores of *Santessonia lagunebergii* (Sérusiaux 5218 & Wessels, holotype, LG) mounted in water.

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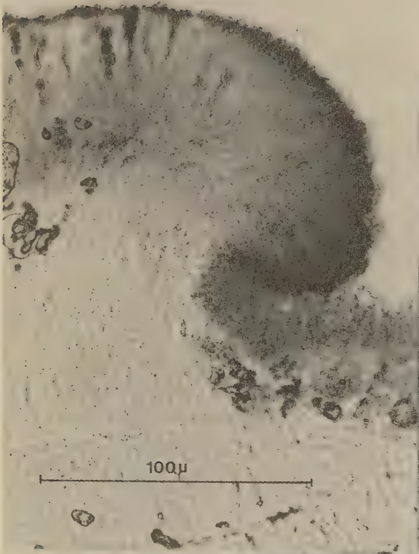

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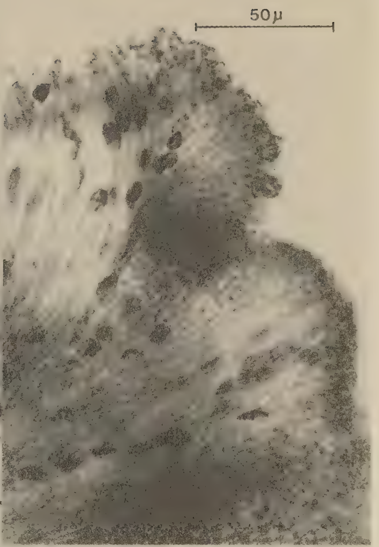

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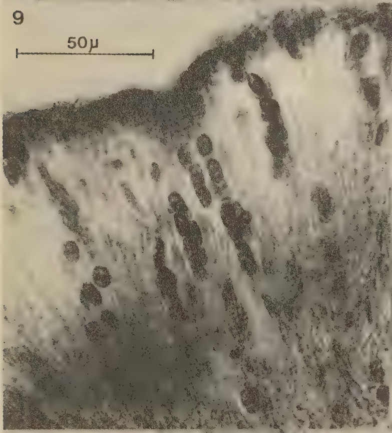

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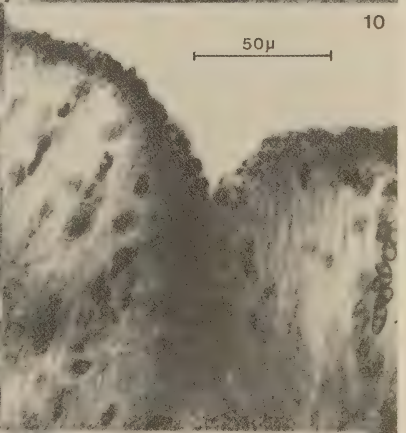

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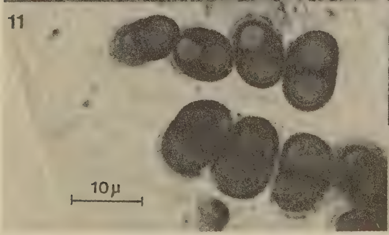

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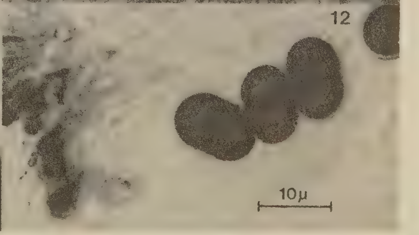

distinct proper margin is not achieved as normally the primordia are immediately raised up by the upward extension of the vegetative thallus. As mentioned by Hale & Vobis (1978), this situation is comparable to pseudopodetial formation in *Thysanothecium* (see Jahns 1970, fig. 103). However, the central axis grows faster than the algal and cortical layers so that a columella can be distinguished. The columella forces the apothecia to be hemispherical. Contrary to *S. lagunebergii*, the excipulum proprium of *S. namibensis* is much reduced in the mature apothecia (fig. 8).

In *Santessonia namibensis*, apothecial development can proceed further by the differentiation of sterile columns within the hymenium (fig. 9-10); this results in a bundle of up to 25 cerebriform apothecia. The primary sterile columns are initiated near epithecium level in mature apothecia; externally they are seen as shallow furrows which gradually assume a concave shape. The continuous growth of the pseudopodetium, especially the central axis, then leads to the isolation of the apothecial fragments as they are delimited by the furrows. Aggregations of cerebriform apothecia are consequently produced. This process may occur several times on the same apothecium in *S. namibensis*. It was also seen in a few specimens of *S. lagunebergii*. Hale & Vobis (1978) observed that spores that have not been ejected were retained in the lower parts of the hymenium and in the hypothecium, as it is the case in *Catolechia wahlenberghii* (see Hafellner 1978, fig. 4) and other lichen genera (*Fuscidea* spp.). This situation has been observed in both fertile species, but more clearly in *Santessonia namibensis* than in *S. lagunebergii*. In the former species, the hypothecium is quite tall (reaching 150 μm) and loose : old and partly disintegrated asci and spores are present throughout. In *S. lagunebergii* however, the hypothecium is much more compact, being compressed by the growing columella, but nevertheless asci and spores are usually present in it.

This similarity with *Catolechia wahlenberghii* does not imply any close relationship between both genera;indeed atrophied spores are a common feature in numerous ascomycete genera (Hawksworth, in litt.). The ascus structure of *Santessonia* is clearly of the *Physcia*-type (Hafellner & al. 1979, confirmed by our observations), while the ascus of *Catolechia* is definitely of different type, similar to that of *Epilichen*, but differs from both the *Physcia* and the *Rhizocarpon*-type (Hafellner 1978, Bellemère & Hafellner 1983, see also Honegger 1980).

The paraphyses (fig. 13) are always anastomosed at their bases, remaining simple above. They are septate and distinctly inflated at the apices where some branching occurs. The walls of their apical cells are typically pigmented brown or almost black, rarely dark green. The spores (fig. 11-13) are 8 per ascus, ellipsoid, 1-septate, first hyaline but soon turn dark blue-green and later dark brown before being ejected. They belong to the *Beltraminia*-type as circumscribed by Mayrhofer (1982); their walls are somewhat evenly thickened. A torus (equatorial ring) and an oil droplet in each cell are easily seen in the immature state. Their outer surface becomes minutely papillose or rarely rugose as soon as they turn dark brown. Ascocarp ontogeny, ascus structure and the spore type leave no doubt as to the placement of the genus in the family Buelliaceae (Hale & Vobis 1978, Hafellner & al. 1979).

DISTRIBUTION AND ECOLOGY

Santessonia now comprises three species, all of which restricted to the Namib desert in South West Africa. To our knowledge it is so far the only lichen genus endemic to that area. Rundel (1978) claimed that the monotypic genus *Combea*, a member of the Roccellaceae, is also endemic to the Namib. Although *Combea mollusca* (Ach.) Nyl. is frequent on the coastal rocks of the desert, it also grows in the Cape Province of South Africa, an area with markedly different ecological conditions and phytogeographical affinities. The distribution pattern of *Combea mollusca* (mapped by Almborn 1966, fig. 13) is shared by several other species, e.g. *Roccella hypomecha* (Ach.) Bory, *Trichoramalina melanothrix* (Laur.) Rundel & Bowler, *Xanthoria flammea* (L. f.) Hillm. and others. *Santessonia namibensis* has been collected three times near Spencer Bay and once near Ugabmond, more than 500 km further north. At the latter locality it is extremely common on a marble ridge running east-west from the shore, being the most conspicuous lichen growing on it. It obviously avoids the spray-zone and appears in perfect condition in the rock crevices at about 500 m away from

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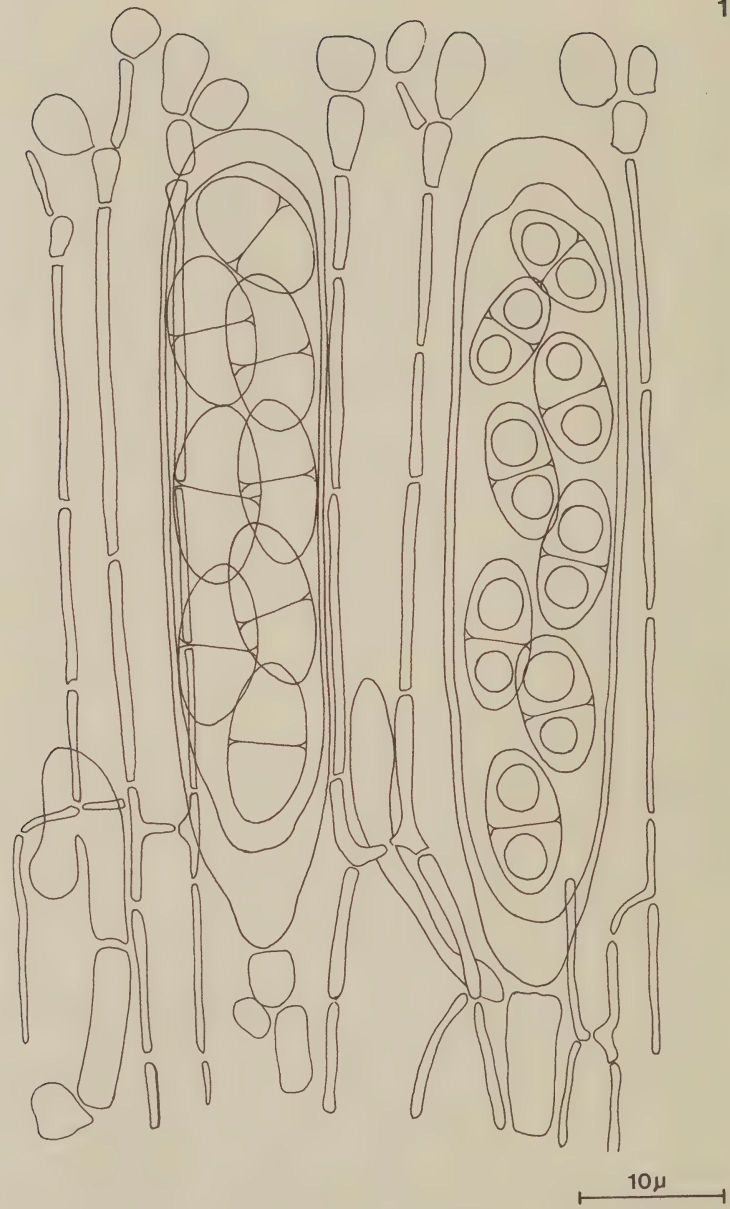
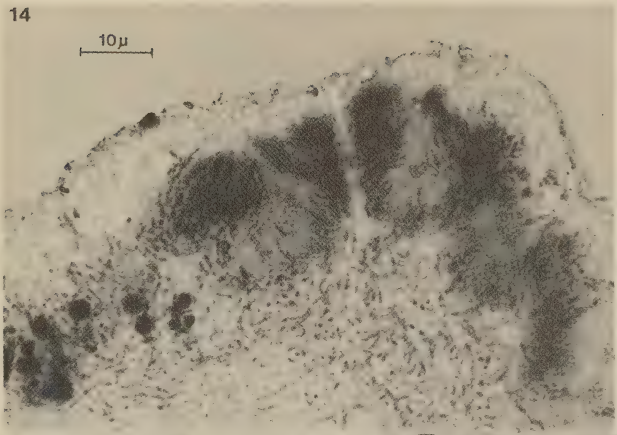


Fig. 13. Cross-section of the hymenium of *Santessonia namibensis* (Sérusiaux 5219 & Wessels, LG).



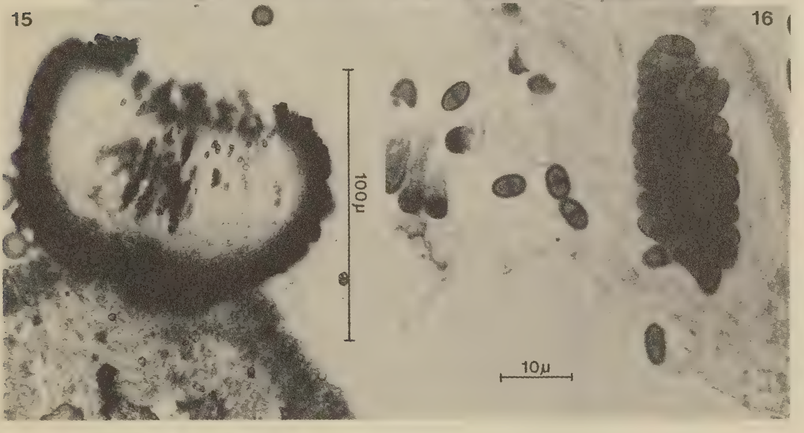


Fig. 14. Cross-section of young pycnidia of *Santessonia lagunebergii* (Sérusiaux 5218 & Wessels, holotype, LG) mounted in lactophenol-cotton blue.

Fig. 15-16. *Dactylospora hafellneriana* (Sérusiaux 5218b & Wessels, holotype, LG). 15 : cross-section of a mature apothecium growing on *Santessonia lagunebergii*, mounted in lactophenol-cotton blue. 16 : portion of hymenium showing a multispored-ascus and several spores.

the beach. Moreover, 1-2 km inland, it colonizes the tops of the ridge as well as (but to a lesser degree) the more protected microhabitats.

Santessonia lagunebergii has an even more restricted distribution in the desert : we have collected it only on the Laguneberg Range where it is common in the southern parts of these granite hills. It grows on small boulders and on pebbles near soil level and rather prefers the sheltered microhabitats.

As might be expected for a sorediate species, *Santessonia sorediata* has a less restricted distribution - at least in the area surveyed by the authors - and has wider ecological requirements. Indeed, the species has been found in several scattered localities, most of which are characterized by the occurence of pebbles on low hills. Surprisingly enough however, it was not abundant, never being a dominant species as are *S. namibensis* and *S. lagunebergii* where they grow.

KEY TO SPECIES

1a. Thallus erect, made of a bundle of 3 to 10 branches, not exceeding 2-3 cm high; branches terete or subterete, never flattened; containing psoromic acid 2

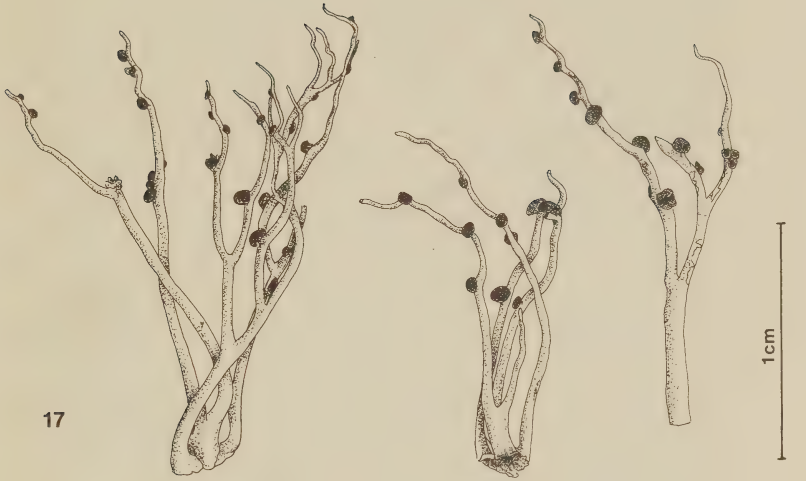
1b. Thallus either erect or decumbent on the ground, extremely variable in size (from 1 to 16 cm long) and in shape (branches terete or strongly flattened and reaching 2 cm in width, erect or prostrate, sometimes with long appendage of spirally twisted branches); containing norstictic acid (fig. 19-21) .... *Santessonia namibensis*

2a. Thallus fertile, always with apothecia, never with soredia (fig. 17)...*Santessonia lagunebergii*

2b. Thallus sterile, always with soredia (fig. 18) .... *Santessonia sorediata*

SANTESSONIA LAGUNEBERGII Sérusiaux & Wessels, sp. nov. Fig. 17

Thallus fruticosus, pallide cinereo-griseus, 1-2(-3) cm altus, valde ad rupes affixus; rami ± cylindrici, 0.4-1.0 mm diam, plerumque simplices vel dichotome ramosi, ± recti, ad apotheciarum positio-



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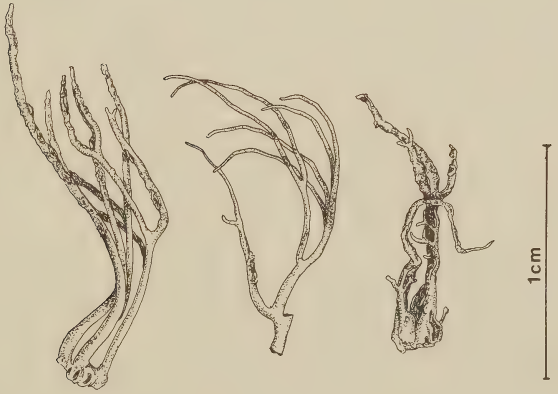

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Fig. 17. Habitus of *Santessonia lagunebergii* (Sérusiaux 5218 & Wessels, holotype, LG).
Fig. 18. Habitus of *Santessonia sorediata* (Sérusiaux 5171 & Wessels, holotype, LG).
Drawings by E. Favaux.

nem geniculati, semper rigentes et fragillimi , laevigati vel pruinosi vel rugosi. Apothecia semper praesentia, lateralia, ± 1.0 mm diam, primo plana et marginata deinde hemisphaerica et reducta margine. Corticale stratum lacunosum cum numerosis mortuis cellulis; algae ± in glomerulis dispositae; centralis axis prosoplectenchymaticus. Excipulum pseudoparenchymaticum, nigro-brunneum; hymenium 90-110 μm crassum, hyalinum; hypothecium 20-30 μm crassum, nigrobrunneum; paraphyses simplices, ad basim anastomosantes et ad apicem ramosae; asci clavati, 8-spori; sporae ellipsoideae, 1-septatae, ad *Beltraminia*-typum pertinentes sed cum toro et crassa pariete, (11-)12-14(-15) x 7-8 μm . Pycnidia numerosa; conidia bacilliformia, 2-3 x 1 μm.Acidum psoromicum continens.

Thallus fruticose, pale ash-gray, 1-2(-3) cm high, made of a bundle of 3 to 10 erect branches, firmly attached to the rocks by a rather thick and compact holdfast; branches cylindrical or slightly flattened, 0.4-1.0 mm in diam (measured at mid-height), ± even in diameter, usually simple or with an isotomic-dichotomous branching pattern (branching angle acute), straight or little flexuose but always rigid, geniculate at the level of apothecia which are born laterally, apices attenuated. Surface smooth, or pruinose, or rugose due to the cortical abrasion, sometimes almost scaled and locally decorticated and then becoming dark grey or black. Thallus very fragile and brittle, even when moistened, especially near the base. Apothecia always present, usually plentiful, lateral, ± 1.0 mm in diam, sometimes up to 1.5 mm, at first plane and distinctly marginate with a dark blue disc covered by a white-blue pruina, soon becoming hemispherical, with a very reduced margin and without pruina. Apothecia often abraded and excavate, very rarely cerebriform. Cortical layer lacunose in typical conditions, especially near the outer surface. Phycobiont layer arranged in ± well-defined glomerules containing many dead cells interspersed with living ones. Central axis dense and compact, made of thick-walled periclinally arranged hyphae. Excipulum composed of radially arranged rows of parallel cells, cells dark brown; hymenium 90-110 μm thick, hyaline; hypothecium 20-30 μm thick, dark brown to dark violet, made of densely interwoven hyphae; paraphyses simple or rarely branched near the apices, anastomosed at their bases, apices distinctly inflated with dark

brown walls; asci claviform, 8-spored; spores ellipsoid, (11-)12-14(-15) x 7-8 µm, 1-septate, at first blue-green with a smooth outer surface, then turning dark brown with a papillose outer surface, of the *Beltraminia*-type but with a distinct torus and an evenly thickened wall (less than 1 µm). Pycnidia frequent, but absent on a few thalli, appearing as small blackish sometimes aggregated knobs, partially and irregularly covered by the thallus cortex (their external appearance is thus quite variable); conidia mostly formed terminally from conidiogenous cells, following the phialid pattern, bacilliform to ± ellipsoid, 2-3 x 1 µm. TLC : psoromic acid.

Type : SW Africa, Namibia, southern part of the Laguneberg Range, 2-3 km N of Myl 72 on the road going from Swakopmund to the Skeleton Coast Park, ± 150 m, granite hill running parallel to the coastline, ± 6 km inland, 2.1983, Sérusiaux 5218 & Wessels (LG-holotype; Univ. North Pietersburg, BM, GZU, US, UPS, herb. Vězda-isotypes).

Other specimen examined : Ibid., but on the northern part of the Laguneberg Range, 4-5 km N of Myl 72 on the road going from Swakopmund to the Skeleton Coast Park, ± 200 m, granite hill running parallel to the coastline, ± 8 km inland, 2.1983, Sérusiaux 5198 & Wessels (LG, Univ. North Pietersburg).

SANTESSONIA NAMIBENSIS Hale & Vobis Fig. 19-21

Specimens examined : SW Africa, Namibia, Spencer Bay, Robinson (both collections cited by Hale & Vobis 1978: 2, including the type, US). Ibid., coast southern Namib, Spencer Bay, Dolphin Head, rocks close to the sea, 1.1974, Giess s.n. (WIND). Ibid., Skeleton Coast Park, 11 km N of the outpost at Ugabmond, following the coastal road, 30 m, marble ridge running in an east-westerly direction, 2.1983, Sérusiaux 5219 & Wessels (LG, Univ. North Pietersburg; to be distributed in the Vězda Lichenes Selecti Exsiccati).

This species was described by Hale & Vobis (1978 : 2-5) from two collections made near Spencer Bay. A further specimen from this area is preserved in the herbarium at WIND : it is quite similar to the type collection. A small rocky ridge near Ugabmond was found covered by a *Santessonia* which is here re-

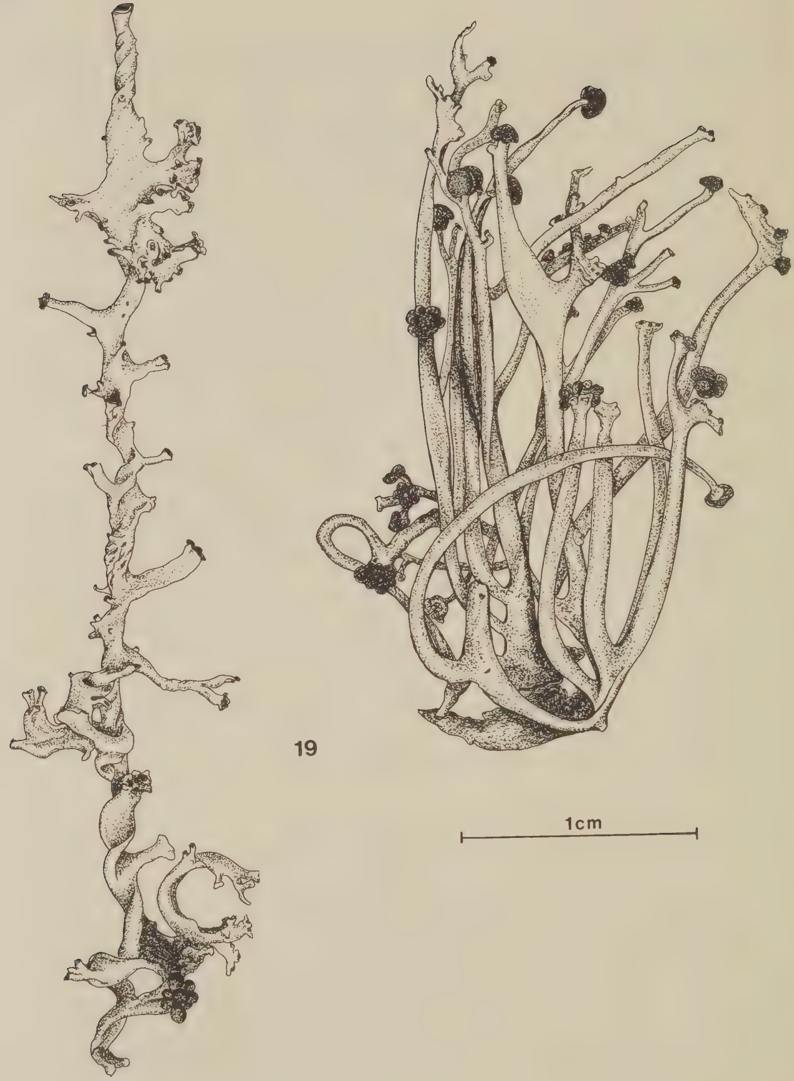

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Fig. 19. Habitus of *Santessonia namibensis* (Sérusiaux 5219 & Wessels, LG). Left : long appendage of spirally twisted lobes; the appendage was detached from the entire thallus for this drawing. Right : a specimen with flattened lobes (except at the branches tips) with apothecia mainly on terminal position. Drawings by E. Favaux.

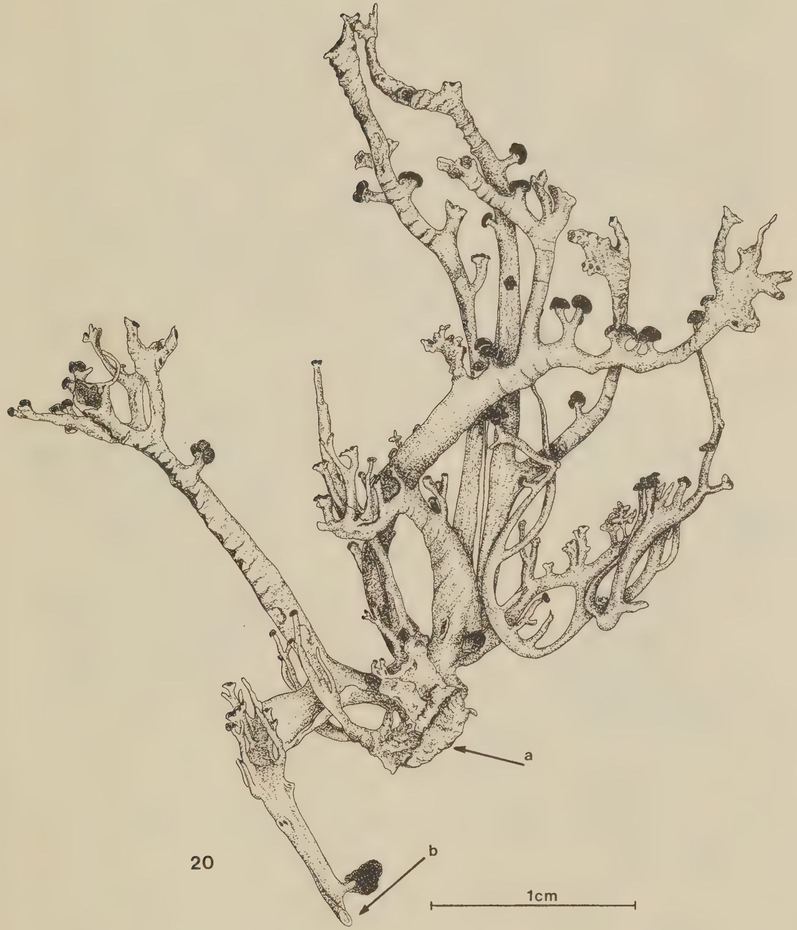

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Fig. 20. Habitus of *Santessonia namibensis* (Sérusiaux 5219 & Wessels, LG). A specimen with subterete lobes with apothecia mainly on lateral pseudopodetia.
Arrow a : holdfast; arrow b : this branch carried an appendage of ± 10 cm long.
Drawing by E. Favaux.

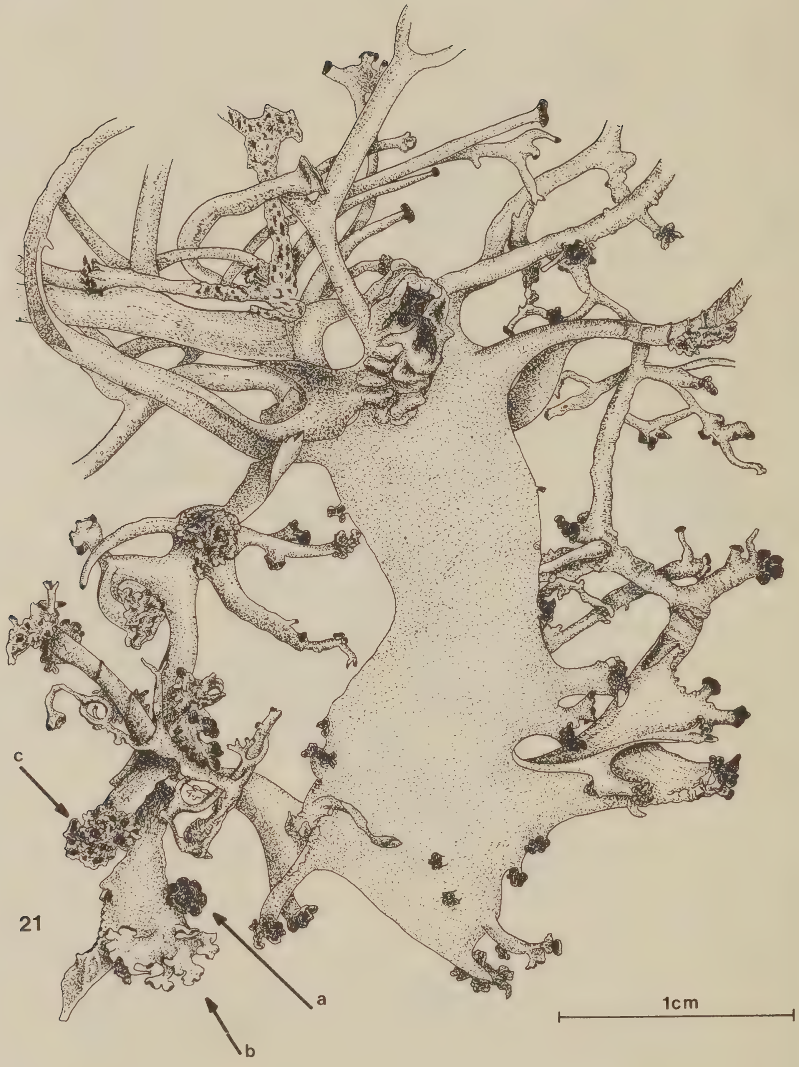

Fig. 21. Habitus of *Santessonia namibensis* (Sérusiaux 5219 & Wessels, LG). A specimen with an extremely wide and flattened lobe. Arrow a : bundle of cerebriform apothecia producing mature spores; arrow b : apothecial primordia disrupted by invading vegetative tissue; arrow c : pycnidia. Drawing by E. Favaux.

ferred to *S. namibensis* with some hesitation. The thallus morphology in this material is extremely variable and specimens with almost any shape one can imagine were found. The branches vary from cylindrical (0.3-0.4 mm in diam) to markedly flattened and reaching 2 cm in width; individuals with erect branches 2-3 cm high were seen with a long (15-16 cm !) appendage of spirally twisted lobes lying on the ground growing on one side, etc. Apothecial primordia can appear on all terminal positions, as well as pycnidia (which can also grow on lateral branchlets). The pycnidia are extremely variable in shape, old ones usually appear as deformed black bursting dots on the surface of branches or branchlets. Although disarmingly variable, the Ugabmond population belongs to a single species. Thallus anatomy, apothecial ontogeny, spores measurements and secondary products (norstictic acid) are similar for all specimens and are in agreement with the type collection of *Santessonia namibensis*. However, the conidia are different : in the Ugabmond specimens, they measure 2-3 x 1 µm and are ellipsoid to bacilliform, whereas in the type of *S. namibensis*, they are cylindrical and reach 5-6 x 1 µm . Thus the Ugabmond population may represent an additional taxon different but nevertheless close to *S. namibensis*. We choose not to take a final decision on this problem; we were so surprised by the extreme variability of the species at Ugabmond that we think wise to see and collect the species at Spencer Bay before describing a fourth taxon in the genus.

SANTESSONIA SOREDIATA Sérusiaux & Wessels, sp. nov. Fig. 18

Thallus ut in *Santessonia lagunebergii* sed semper sterilis et soredia producens; soralia subtuberculiformia, typice rotundata vel difformia et confluentia ubi veteria; soredia minuta, caesia vel atrobrunnea ubi veteria.

The thallus of *S. sorediata* closely ressembles that of *Santessonia lagunebergii* except that it is never fertile and that it produces soredia. The branches also are sometimes more slender and more irregular than those of its fertile counterpart. Soredia usually arise within discrete soralia which can be described as subtuberculate. Typical soralia are almost round and have a narrow and irregular cortical rim but as they are not distinctly raised, they cannot be compared with genuine tuberculate soralia. Their shape however can vary considerably : in old specimens, they are difformed and so abundant that they become confluent. They are mostly produced in the upper parts of the branches and certainly induce torsion and some twisting on them. Soralia are small (20-40 µm in diam), bluish or dark brown when old (fig. 6). TLC : psoromic acid.

In a recent paper about the species pair concept in lichenology, Tehler (1982) claimed that recognition of the species rank to sorediate counterpart of fertile species is without any natural basis. His arguments are unquestionably coherent but are based on theoretical assumptions. In the particular case dealt with here (*Santessonia sorediata* vs *S. lagunebergii*), we paid extreme attention to the populations of both species at the sole locality where they grow together (see collections 5197 and 5198). Production of soralia or apothecia is obviously not an age related effect and not a single specimen with both soralia and apothecia was seen. We therefore decided that the species rank was appropriate. Nevertheless we are aware that our choice could be questionned by future experimental studies on the relationships between asexual and sexual counterparts.

Type : SW Africa, Namibia, 4 km E of the road going from Swakopmund to the Skeleton Coast Park, on undulating low hills SW of the Messum Crater Range, 120 m, low hills covered with large pebbles, 2.1983, Sérusiaux 5171 & Wessels (LG-holotype; Univ. North Pietersburg, BM, US, UPS, herb. Vězda-isotypes).

Other specimens examined : Ibid., northern part of the Laguneberg Range, 4-5 km N of Myl 72 on the road going from Swakopmund to the Skeleton Coast Park, ± 200 m, granite hill running parallel to the coastline, ± 8 km inland, 2.1983, Sérusiaux 5197 & Wessels. Skeleton Coast Park, 23 km N of the outpost at Ugabmond following the coastal road, 30 m, undulating stabilized dunes covered with pebbles, 2.1983, Sérusiaux 5244 & Wessels. Namib Naukluft Park, E of Swakopmund, road to Goanrikontes, 200 m, undulating hill, pebbles-covered low hills, 2.1983, Sérusiaux 5262 & Wessels (all in LG and Univ. North Pietersburg).

LICHENICOLOUS FUNGI

In the area investigated by the authors, the *Santessonia* species host several parasitic or parasymbiontic fungi. These were almost completely overlooked in the field but they are undoubtely rare as only few of the numerous thalli collected are attacked. Their identification turns out to be quite difficult, even at the generic level. Nevertheless, one species is easily referred to *Dactylospora* Körber, a genus monographed by Hafellner (1979). The ascus structure of this genus is extremely typical (thick external gelatinous cap that reacts blue upon iodine treatment) and besides is used to distinguish a separate family (Bellemère & Hafellner 1982). The parasymbiont collected on *Santessonia lagunebergii* represents a new species, described here and named in honour of J. Hafellner whose contribution to the taxonomy of the genus is outstanding. This new species is close to *Dactylospora pertusaricola* (Willey in Tuck.) Hafellner, the only other species with more than 8 spores per ascus. In *D. hafellneriana*, the apothecia are much smaller and distinctly urceolate, the spores are smaller and always with a single septum only and the paraphyses apices are much less pigmented than those of *D. pertusaricola*. The latter species is only known from Massachussetts, U.S.A., growing on a saxicolous species of *Pertusaria*.

DACTYLOSPORA HAFELLNERIANA Sérusiaux, sp. nov.

Apothecia crescentia ad thallum *Santessoniae lagunebergii*, plus minusve numerosa, 0.1(-0.2) mm diam., primum semiimmersa, deinde proeminentia, ad basim constricta et urceolata, margine distincto rugulosoque. Excipulum pseudoparenchymaticum, cellulis plus minusve radiatim dispositis, parietibus atrobrunneis. Hymenium hyalinum; hypothecium brunneum vel nigrum; paraphyses simplices, superne paulum ramosae et apicibus incrassatis et brunneis. Asci clavati, cucullis gelatinosis iodo caerulescentibus circumdati, 20-40 spori. Sporae ellipsoideae, 1-septatae, brunneae, 5-7 x 3-4 µm.

Apothecia growing on the thallus of *Santessonia lagunebergii*, especially at the bases of branche sometimes also on apothecia, more or less numerous, first half-immersed in the host thallus but soon distinctly superficial and strongly constricted at the base, urceolate, with a distinct and persistent margin, appearing rugose at high magnification, black, ± 0.1 mm in diameter, sometimes reaching 0.2 mm, up to 90 µm high. Excipulum pseudoparenchymatous, with more or less radiately arranged isodiametric cells, cell walls dark brown on the outer parts, becoming paler inwards, 10-15 µm thick. Hymenium hyaline, 40-60 µm high; hypothecium brown to blackish, made of irregularly interwoven cells, sometimes almost parenchymatous. Paraphyses simple and septate, sparsely branched and inflated at apices, walls of apical cells brownish. Asci clavate with a I+ intensely blue gelatinous cap, internal layers I-. Spores 20-40 per ascus, usually about 30, ellipsoid, 1-septate, not constricted at the septum, brown,5-7 x 3-4 µm.

Type : SW Africa, Namibia, southern part of the Laguneberg Range, 2-3 km N of Myl 72 on the road going from Swakopmund to the Skeleton Coast Park, ± 150 m, granite hill, growing on *Santessonia lagunebergii*, 2.1983, Sérusiaux 5218b & Wessels (LG-holotype; GZU-isotype).

ACKNOWLEDGEMENTS

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REFERENCES

Almborn, O. 1966. Revision of Some Lichen Genera in Southern Africa. I. Bot. Not. 119 : 70-112.

Bellemère, A. & Hafellner, J. 1982. L'ultrastructure des asques du genre *Dactylospora* (Discomycètes) et son intérêt taxonomique. Cryptogamie, Mycologie 3 : 71-93.

Bellemère, A. & Hafellner, J. 1983. L'appareil apical et la paroi des ascospores du *Catolechia wahlenberghii* (Ach.) Flotow ex Koerber et de l'*Epilichen scabrosus* (Ach.) Clem. ex Haf. (Lichenes, Lecanorales) : étude ultrastructurale. Cryptogamie, Bryol. Lichénol. 4 : 1-36.

Culberson, C.F. & Amann, K. 1979. Standardmethod zur Dünnschichtchromatographie von Flechtensubstanzen. Herzogia 5 : 1-24.

Follmann, G. 1967. Zur Bedeutung der Salzbestäubung für den Wasserhaushalt von Küstenflechten. Ber. Deut. Bot. Ges. 80 : 206-208.

Goudie, A. 1972. Climate, weathering, crust formation, dunes and fluvial features of the Central Namib Desert, near Gobabeb, South West Africa. Madoqua, sér. 2, 1 : 15-31.

Hafellner, J. 1978. *Catolechia* Flotow ex Massalongo emend. Körber und *Epilichen* Clements ex Hafellner - zwei nahe verwandte Flechtengattungen. Nova Hedwigia 30 : 673-692 + 4 pl. h.t.

Hafellner, J. 1979. *Karschia*. Revision einer Sammelgattungen an der Grenze von lichenisierten und nichtlichenisierten Ascomyceten. Beih. Nova Hedwigia, 62, 248 pp.

Hafellner, J., Mayrhofer, H. & Poelt, J. 1979. Die Gattungen der Flechtenfamilie Physciaceae. Herzogia 5 : 39-79.

Hale, M.E., Jr. 1976. Lichen Structure viewed with the Scanning Electron Microscope. In : Brown, D.H., Hawksworth, D.L., Bailey, R.H. : Lichenology : Progress and Problems, pp. 1-15 + XI pl. h.t. Academic Press, London, New York and San Francisco.

Hale, M.E., Jr. & Vobis, G. 1978. Santessonia, a new lichen genus from Southwest Africa. Bot. Not. 131 : 1-5.

Honegger, R.M. 1980. The ascus apex in lichenized fungi. II. The *Rhizocarpon*-type. Lichenologist 12 : 157-171.

Jahns, H. 1970. Untersuchungen zur Entwicklungsgeschichte der Cladoniaceen. Nova Hedwigia 20 : 1-177.

Larson, D.W. 1981. Differential Wetting in Some Lichens and Mosses : The Role of Morphology. Bryologist 84 : 1-15.

Mayrhofer, H. 1982. Ascosporen und Evolution der Flechtenfamilie Physciaceae. Jour. Hattori Bot. Lab. 52 : 313-321.

Nagel, J.F. 1962. Fog precipitation measurements of Africa's southwest coast. Notos 11 : 51-60.

Nylander, W. 1868. Lichenes Angolenses Welwitschiani. Bull. Soc. Linn. Normandie, 2e série, 2 : 508-521.

Rogers, R.W. 1977. Lichens of Hot Arid and Semi-Arid Lands. In : Seaward, M.R.D. : Lichen Ecology, pp. 211-252. Academic Press, London, New York and San Francisco.

Rundel, P.W. 1974. Water Relations and Morphological Variation in *Ramalina menziesii* Tayl. Bryologist 77 : 23-32.

Rundel, P.W. 1978. Ecological Relationships of Desert Fog Zone Lichens. Bryologist 81 : 277-293.

Rundel, P.W. 1982. The role of morphology in the water relations of desert lichens. Jour. Hattori Bot. Lab. 53 : 315-320.

Tehler, A. 1982. The species pair concept in lichenology. Taxon 31 : 708-717.

Vainio, E.A. 1901. Lichenes. In : Hiern, W.P. & Rendle, A.B. : Catalogue of the African Plants collected by Dr. Friedrich Welwitsh in 1853-1861. Vol. 2 (2), pp. 396-463. London.

Van Zinderen Bakker, E.M., 1975. The origin and palaeoenvironment of the Namib Desert biome. J. Biogeogr. 2 : 65-73.

Ward, J.D., Seely, M.K. & Lancaster, N. 1983. On the Antiquity of the Namib. S. Afr. J. Sci. 79 : 175-183.

Werger, M.J.A. 1978. The Karoo-Namib Region. In : Werger, M.J.A. : Biogeography and ecology of Southern Africa, pp. 231-299. Junk, The Hague.

MYCOTAXON

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NOTES ON CORTICIACEAE (BASIDIOMYCETES) XIII

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SUMMARY

Four new species are described from North Europe: Amylocorticium pedunculatum, characterized by smooth and amyloid spores, stalked basidia, and a cream-yellowish hymenium; Gloeocystidiellum porosellum which is closely related to G. porosum but lacks clamps and with spores more ellipsoid; Steccherinum cremeoalbum is allied to S. subcrinale but distinguishable with its shorter aculei and slightly larger spores; finally Subulicium minus which resembles S. lautum but delimited in having smaller spores and cystidia. All collections mentioned are at the herbarium of Göteborg (GB) if otherwise is not indicated.

AMYLOCORTICIUM PEDUNCULATUM Hjortst. spec. nov. Fig.1.

Fructificatio arte resupinata, cremea vel luteola, levis, in sicco distincte membranacea, margine vulgo fibrilloso; systema hyphale monomiticum, hyphis basalibus tenuitunicatis, 2.5-3.5 um latis, interdum incrustatis, hyalinis, fibulatis, hyphis subhymenialibus irregularibus, circiter 2-2.5(-3) um latis, itidem fibulatis; cystidia nulla; basidia subclavata, basaliter pedunculata, 25-30(-40) x 5-7 um, 4-sterigmata; sporis ellipsoidibus, tenuitunicatis, levibus, versus apicem paulo latioribus, circiter 7-8 x 3-3.5 um, amyloidibus.

HOLOTYPUS: Sweden. Ångermanland. Ådalsliden par., Fängsjö, about 2 km E. of lake Fängsjön, on fallen trunk of Picea. 1970-09-23, leg. K. Hjortstam No. 4454. ISOTYPUS: UPS.

Fruitbody closely adnate, effuse, membraneous, thin and rimulose, cream-coloured to light yellow, smooth, in well developed specimens with the margin fibrillose. Hyphal system monomitic, hyphae thin-walled, narrow, 2.5-3 um wide, hyaline, subicular hyphae straight and uniform, forming a very thin layer next to the substratum, as a rule slightly encrusted, subhymenial hyphae narrower, irregular, about 2-2.5(-3) um, all hyphae with clamps. Cystidia lacking.

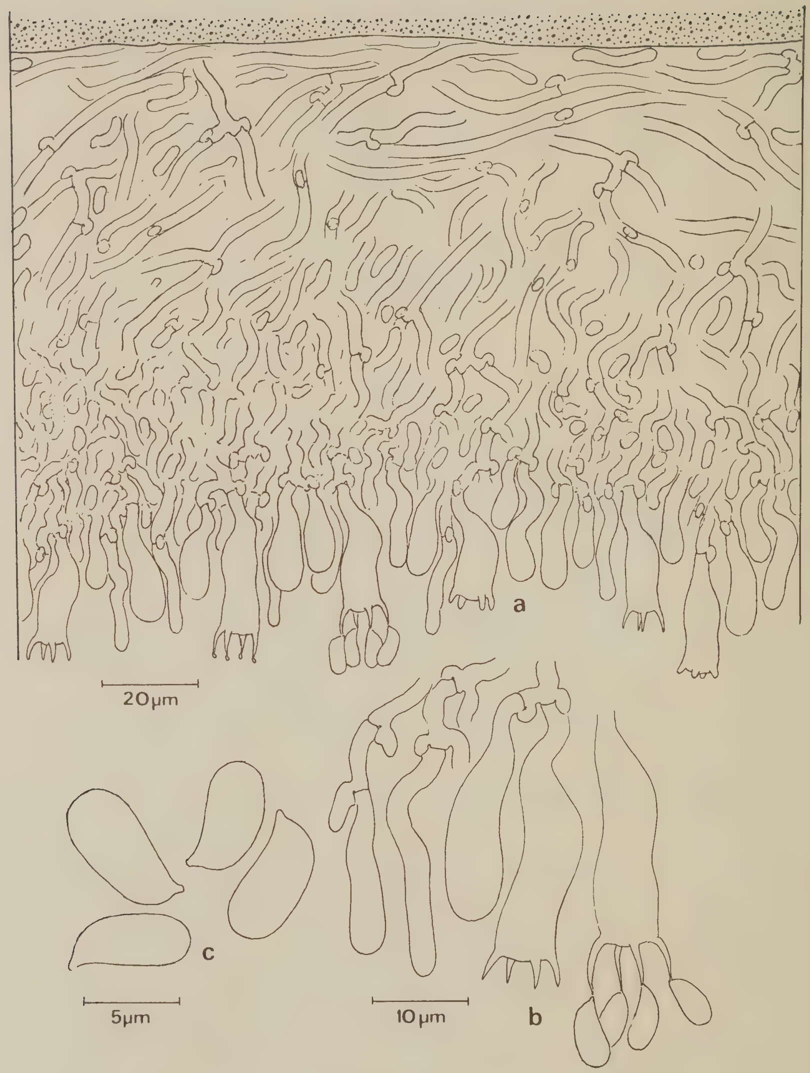

Fig. 1. Amylocorticium pedunculatum a) section through fruitbody b) basidia c) spores.— From the type.

Basidia subclavate, 25-30(-40) x 5-7 um, distinctly stalked, smooth, bearing four sterigmata and with a basal clamp. Spores ellipsoid, broader towards the apex, thin-walled, smooth, 7-8 x 3-3.5 um, varying slight in size, amyloid.

Remarks. On decayed trunks, branches, and other substrata on the ground. According to the collections with preference to coniferous wood, but also on Betula, and from Central Europe (one collection) on Athyrium filix-femina. In North Europe seemingly with a northern distribution.
On account of the amyloid spores this fungus would seem to belong in *Amylocorticium*, in spite of its basidial similarity with species in *Athelopsis*. It is somewhat closely related to *Amylocorticium laceratum* but differs in important characteristics. The spores of the latter are allantoid and the hymenium is fairly thin, whitish and more strikingly athelioid (pellicular). The basidia in *A. pedunculatum* are also longer and with narrower stalk.
In its strict sense *Amylocorticium* comprises nine known taxa (Hjortstam 1980 and 1983) but could as well be divided into two sections.
1) *A. laceratum* and *A. pedunculatum*. Both species have stalked basidia and a spore-morphology different from others. The fruitbodies are thinner, almost pellicular to membraneous.
2) The remaining species with rather uniform macro-and micromorphologies. However, *A. rhodoleucum* is still an unknown taxon and somewhat isolated as to its clampless hyphae.

Additional specimens.

Czechoslovakia. Carpatorossia, Bilý Potok, Trebušany, alt. 800-1500 m, on Athyrium filix-femina. 1935-10-11, leg. Pilát (GB No. 23160). *Norway*. Akershus. Eidsvoll, Mistberget, northern slope by Tisjøen, alt. 400 m, on Picea. 1978-09-26, leg. Hjortstam & Larsson (Hjm 10121):Hordaland. Ulvik, near Finse railwaystation, alt. ca. 1200 m, on snow-fence (coniferous wood). 1979-09-01, leg. E. Johannesen (O): do. on snow-fence (Pinus sylvestris). 1982-08-27, leg. S. Aandstad No. 797 (O): Oppland. Lunner, Søndre Oppdalen in rich Picea wood, ca. 430-460 m, on Picea stump. 1979 and 1980, leg. E. Bendiksen No. 1216/a and 1226 (O): Sør-Trøndelag. Oppdal, Dovre Nat. Park, along the river Driva, ca. 900 m, on Betula pubescens (B. tortuosa). 1980-08-21, leg. Hjortstam No. 11641: do. path between the research station and Nordre Knutshø, ca. 1100 m, on Juniperus. 1980-08-21, leg. Hjortstam No. 11609: do. Røros, Kridalen, on dead Pinus. 1971-07-22, leg. G. Gulden (GB,O). *Sweden*. Västergötland. Varnhem, Sydbillingen, wood between Storemossen and Orrsjön, on Picea trunk. 1976-09-30, leg. Hjortstam/Hallingbäck/Jacobsson: Södermanland. Stockholm, Nacka kvarnar. 1889-09-28, leg. L. Romell (GB,S): Lappland. Dorotea, Vallsjöskogen, on Picea trunk with cubic rotting. 1982-08-15, leg. K.-H.Larsson No. 2634.

GLOEOCYSTIDIELLUM POROSELLUM Hjortst. spec. nov. Fig.2.

Fructificatio arte resupinata, effusa, pallide cremicolor, levis, in sicco ceracea vel submembranacea, 0.1-0.2 mm crassa, margo tenuis vel indeterminatus; systema hyphale monomiticum, hyphis tenuitunicatis, aliquantum irregularibus, ramosis, 2-2.5 um latis, hyalinis, fibulis nullis; sulphocystidia numerosa, tenuitunicata, subfusiformia, cum singulis, vel rarius binis, schizopapillis, 50-50 x 7-8 um; basidia anguste subclavata, constricta, (15-)20-25 x 3.5-4 um, 4-sterigmata; sporis ellip-

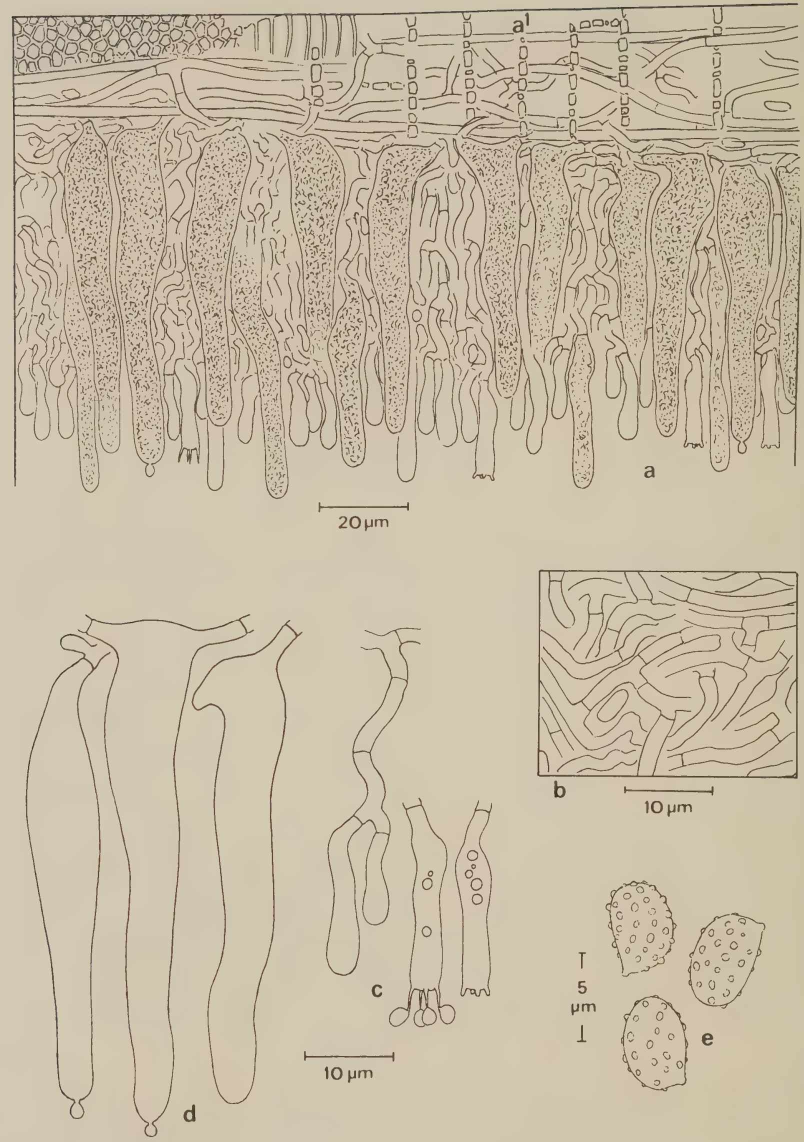
a1
a
20 µm
b
10 µm
c
10 µm
d
5 µm
e

Fig. 2. Gloeocystidiellum porosellum a) section through fruitbody a1) wood (Corylus) in radial length section b) horizontal section showing hyphae in subiculum c) basidia d) gloeocystidia e) spores.— From the type.

soidibus, subtiliter verrucosis, 5-5.5(-6) x 3-3.5 um, valde amyloidibus.

HOLOTYPUS: Sweden. Västergötland. Brunn par., Kråkeboberg, on fallen trunk of Corylus avellana. 1977-09-21, leg. K. Hjortstam No. 8851. ISOTYPUS: S.

Fruitbody resupinate, effuse, cream-coloured, when dried ceraceous or submembraneous, smooth, fairly thin, about 0.1-0.2 mm thick, margin thinning out or indeterminable, rarely farinaceous or byssoid. Hyphal system monomitic, hyphae thin-walled, 2-2.5 um wide, richly branched, irregularly arranged next to the substratum, in the subhymenial layer more dense but well separable in a crush-preparation. Sulphocystidia numerous, subfusiform and provided with one or more rarely two outgrowths (schizopapillae), thin-walled, with oily inclusion in the protoplasm. 50-60 x 7-8 um, with distinct reaction to sulphovanillin. Basidia narrowly subclavate, often with median constriction, (15-)20-25 x 3.5-4 um, with four sterigmata, without a basal clamp. Spores ellipsoid, finely verrucose, with warts easily observed in both KOH and Melzer´s reagent, 5-5.5(-6) x 3-3.5 um, strongly amyloid.

Remarks. Gloeocystidiellum porosellum is readily recognized by its clampless hyphae, relatively loose tissue, sulphocystidia, and rough, amyloid spores. It is evidently similar to G. porosum and G. clavuligerum (Nakasone, 1982) but it is easily separated from both of them as these fungi possess clamps at every septa.
G. heimii (Boidin, 1966), originally described from Africa, is also similar to the new species. The cystidia in that species are, however, distinctly broader and schizopapillae have not been observed. Furthermore, the hymenium is dotted by reddish excretion, seemingly arisen from the cystidia, which can not be seen in G. porosellum.
Another species, Conferticium karstenii (Hallenberg, 1980) should also be mentioned. The species was formerly placed in Gloeocystidiellum but transferred to Conferticium because of the fact that basidial repetition occurs. Another characteristic, and more easily observed, is the very distinct stratification, which all species in the genus have in common. Though G. porosellum and C. karstenii have similarities such as clampless hyphae and rough spores (but considerably larger, up to 6-7 x 4 um in C. karstenii), it will be seen from the above mentioned characteristics that they are clearly defined on both the generic and the specific level.

STECCHERINUM CREMEOALBUM Hjortst. spec. nov. Fig.3,4.

Fructificatio resupinata, effusa, cremeoalba, grandinioides vel odontioides, aculeis circiter 0.1-0.3 mm longis, 4-6 per mm, mediocriter conicis, apicem versus leviter fimbriatis, margo fibrillosus, concolor vel albus; systema hyphale dimiticum, hyphis skeleticis crassitunicatis, 2.5-3.5 um latis, hyphae generatoriae tenuitunicatae, 2-3(-3.5) um, omnes fibulatae; cystidia (pseudocystidia) numerosa, incrustata, longissima, plerumque 100-200 x 5-10 um; basidia plus minus clavata, leviter constricta, 4-sterigmata; sporis subglobosis, tenuitunicatis, levibus, (3.2-)3.5-4 x 2-2.2 um, inamyloidibus, indextrinoidibus.

HOLOTYPUS: Sweden. Västmanland. Västanfors par., Högbyn, N. of the lime-stone quarry. 1974-08-10, leg. I. Nordin.

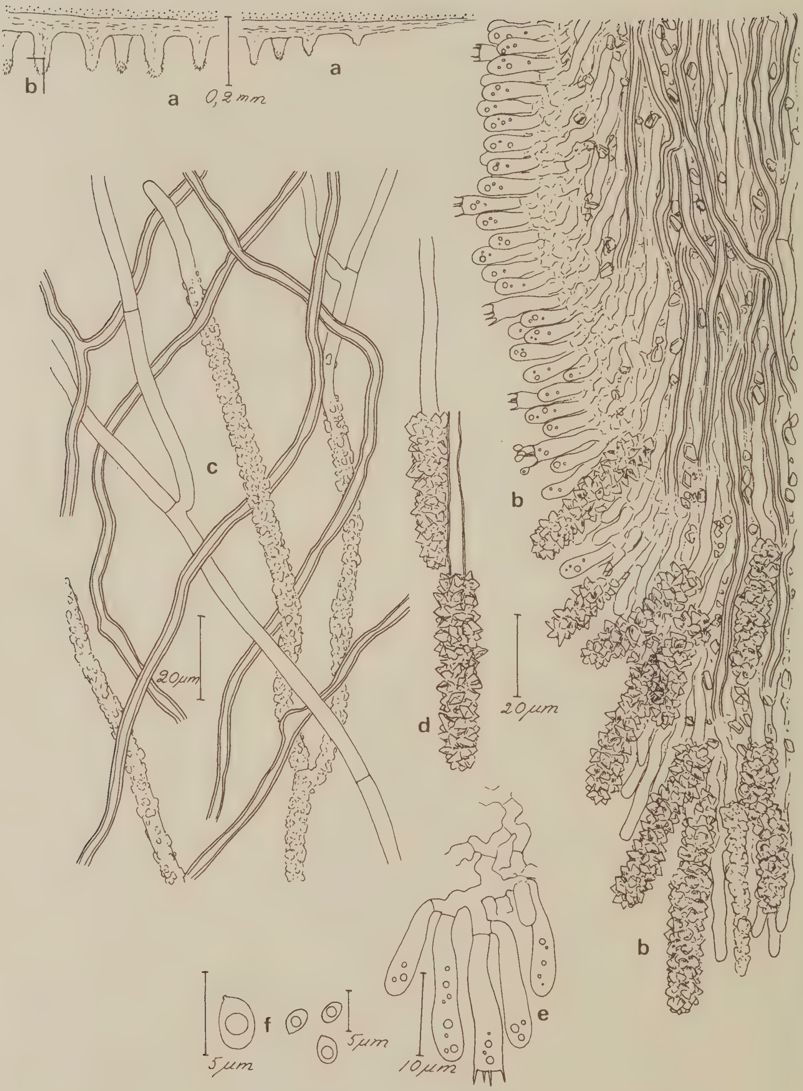
a
b
a
0,2 mm
b
c
20µm
d
20µm
b
b
e
f
5µm
5µm
10µm

Fig. 3. Steccherinum cremeoalbum a) section through fruitbody showing position of b b) section through aculeus c) generative and skeletal hyphae d) cystidia e) basidia f) spores.— From the type.

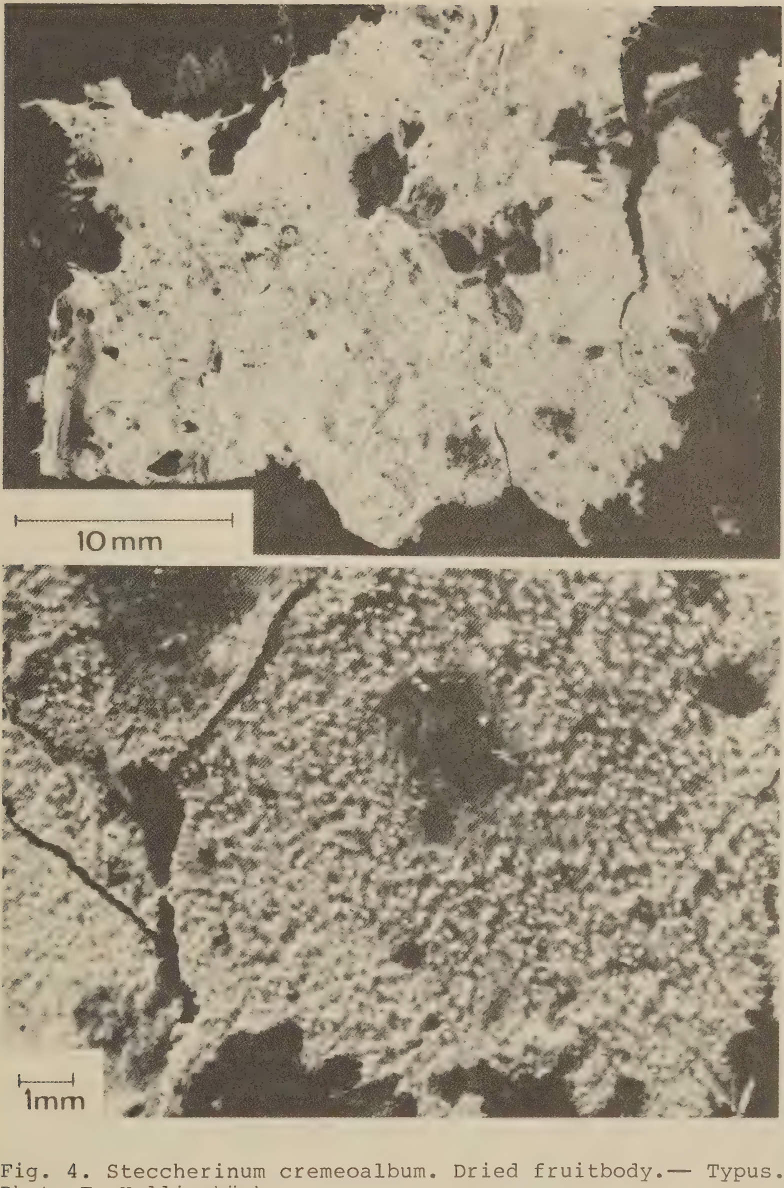

Fig. 4. Steccherinum cremeoalbum. Dried fruitbody.— Typus. Photo T. Hallingbäck.

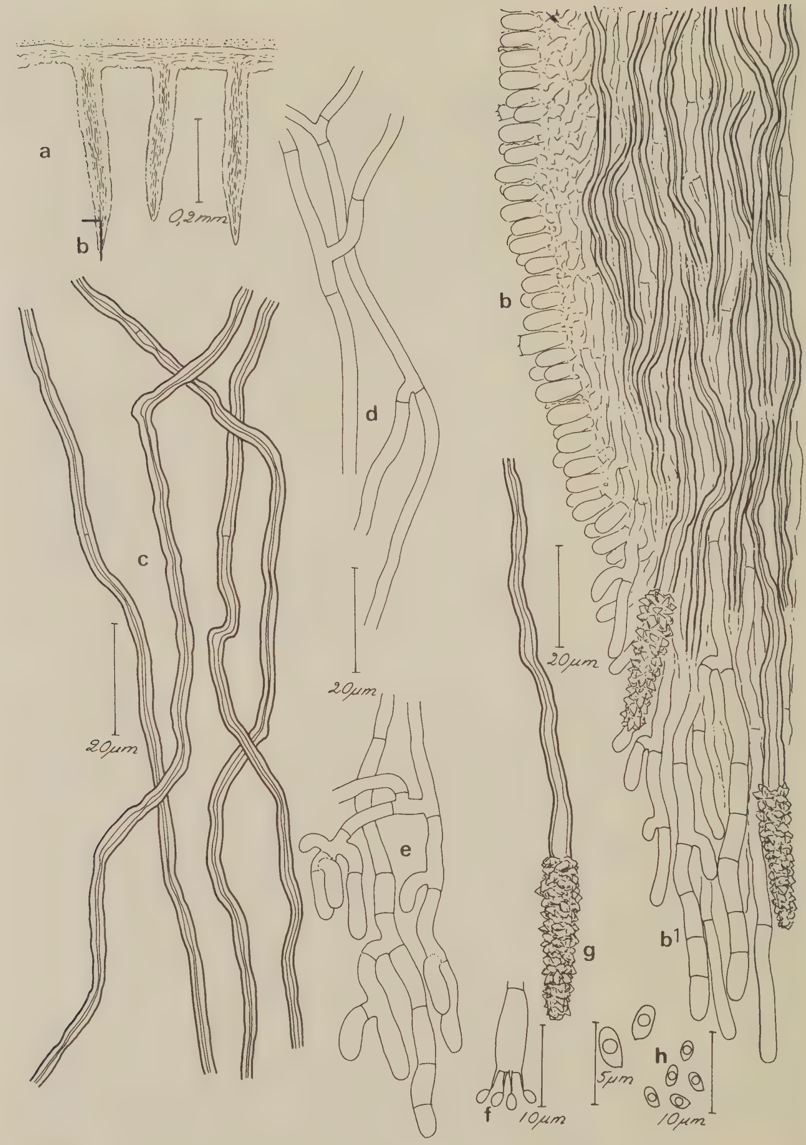
a
0,2mm
b
d
b
c
20µm
20µm
20µm
e
g
b1
f
10µm
5µm
h
10µm

Fig. 5. Steccherinum subcrinale a) section through fruitbody showing position of b b) section through aculeus b1,e) short-celled hyphae c) skeletal hyphae d) generative hyphae from subhymenial layer f) basidium g) cystidium h) spores. — Coll. I. Johansen 866/74.

Fruitbody closely adnate, effuse, thin, not easily separable from the substratum, cream-coloured, grandinioid or gradually odontioid, aculei about 0.1-0.3 mm long and approximately 4-6 per mm, moderately conical and slightly fimbriate at the tip, concolorous with the smooth hymenium between the aculei, margin distinctly fibrillose with rhizomorphs whitish, usually paler than the hymenium. Hyphal system dimitic, with skeletal hyphae thick-walled, sparsely branched, slightly, or some hyphae, heavily encrusted, 2.5-3.5 um wide, non-septate but some adventitious septa occur, generative hyphae thin-walled, some richly encrusted, simple septate, 2-3(-4) um wide. Cystidia (pseudocystidia) numerous, especially in the aculei, towards the widened tip encrusted, usually very long with the encrusted part 40-60 x 7-10 um. Basidia more or less clavate, 18-20 x 4-5 um, slightly constricted and with four sterigmata, without basal clamp. Spores subglobose, thin-walled, smooth, (3.2-)3.5-4 x 2-2.2 um, non-amyloid, non-dextrinoid or cyanophilous.

Remarks. Steccherinum cremeoalbum is recognized by its odontioid hymenial surface with whitish colour and fimbriate margin. Under the microscope differently shaped from other species in the genus, except S. subcrinale, by lacking clamps. It can easily be separated from that species by its much shorter aculei, never elongated and somewhat sinuous. The new species also lacks the distinctive short-celled, terminal hyphae in the aculei, which are much characteristic in all specimens seen of S. subcrinale (compare fig. 5). Besides, the spores are slightly larger in S. cremeoalbum.

Additional specimen.

Denmark. Sjaelland. Korsör Skov, on deciduous wood. 1971-07-10, leg. K. Hauerslev No. 4054.

SUBULICIUM MINUS Hjortst. spec. nov.

Fructificatio resupinata, effusa, exalbida, conspicua, reticulata vel postea continua, levis; systema hyphale monomiticum, hyphae tenuitunicatae, 2-2.5(-3) um late, fibulis nullis; cystidia (plagiocystidia) numerosa, admodum 60-80 um longa, levia, ad basim 7-8 um lata, subulata, ad apicem plus minus mucronata, tenuitunicata vel crassiuscula, gloeocystidia vel basidiola frequenter in collectionibus reperta, sinuosa, circiter 30-50 x 4-5 um; basidia subclavata, 15-20 x 4.5-5.5 um, 4-sterigmata; sporis globosis vel subglobosis, tenuitunicatis (vel leviter crassiusculis), levibus, 4-4.5 diametro vel 4.5-5 x 4 um, neque amyloidibus neque cyanophilis neque dextrinoidibus.

HOLOTYPUS: Sweden. Östergötland. W. Tollstad par., Omberg, Storpissan nature reserve, in herb-rich Picea wood, on Picea. 1979-11-09, leg. Hjortstam & Hallingbäck, Hjm 11307.
PARATYPUS: idem Hjm 11323.

Fruitbody resupinate, effuse, whitish, conspicuous, reticulate, when fully developed continuous, smooth but under a lens (50 X) slightly pilose by projecting and light-refracting cystidia. Hyphal system monomitic, basal hyphae straight with fairly sparse ramifications, thin-walled, hyaline, narrow, 2-2.5 um wide, subhyaline hyphae sinuous, mostly 2.5-3 um wide, all hyphae without clamps. Cystidia numerous, gene-

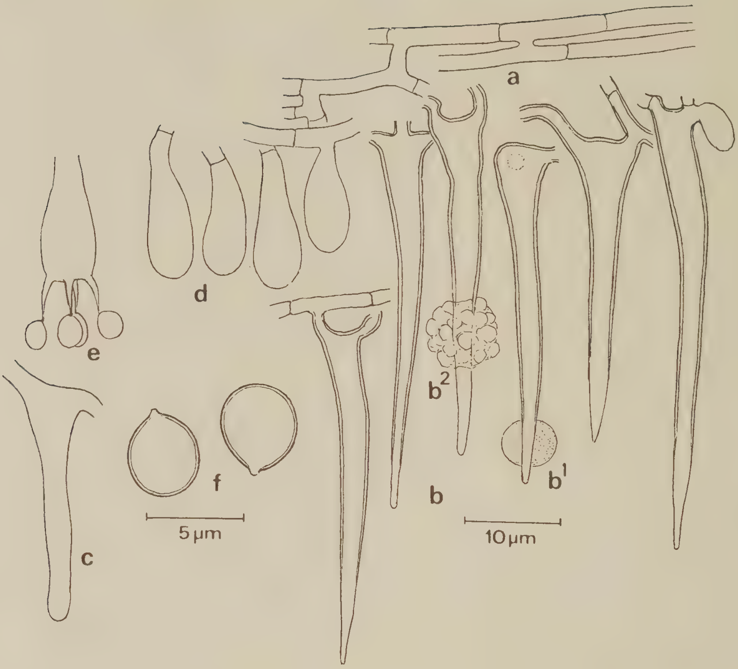

Fig. 6. Subulicium minus a) hyphae b) cystidia b^{1}) cystidium with dried drop of excreted matter b^{2}) drop with stuck spores c) young cystidium d) undeveloped basidia e) basidium with four spores f) spores.— From the type.

rally as plagiocystidia (see Boidin & al., 1980 p.279), smooth, subulate, at the base more or less ventricose, apically mucronate, usually 60-80 um long and towards the base 7-8 um width. Gloeocystidia or basidioles occur frequent in the collections, slightly sinuous, with a more dense protoplasm than in the basidia, 30-50 x 4-5 um. Basidia subclavate, 15-20 x 4.5-5.5 um, with four sterigmata, without a basal clamp. Spores globose to subglobose, thin-walled or with slight wall thickening, 4-4.5 um across or 4.5-5 x 4 um, non-amyloid, non-dextrinoid and without a visible cyanophilous reaction.

Remarks. Subulicium minus is similar to S. lautum (Hjortstam & Ryvarden, 1979) but has spores and cystidia considerably smaller. In the latter species the spores are globose to subglobose, 6-7 um or 6-8 x 4.5-7 um respectively, and the cystidia are very long, often more than 100 um. Under a lens (50 X) the hymenium of S. lautum is pilose by numerous projecting cystidia, while in S. minus this is less pronounced. Another species which is also closely related to S. minus is

S. rallum (Jülich & Stalpers, 1980), but this is with certainty distinguished by its terminal and strongly encrusted cystidia. The same kind of crystal-ornamentation can also be seen on hyphae and basidia-base.
With some uncertainty Hjortstam & Ryvarden (1979) placed Peniophora ralla in the genus Subulicystidium Parm., preferably by its deviating cystidial morphology compared to those in Subulicium. In other respects, it conforms to the characteristics with Subulicium, e.g. lacking clamps, spores globose to subglobose, and subulate cystidia. Liberta (1980) concluded that the encrusted cystidia of P. ralla is morphological similar to the species included in Subulicystidium but "lack the ribbon-like ornamentation of wall material...". Thus, I follow Jülich and Stalpers who transfer the species to Subulicium.

ACKNOWLEDGEMENTS

I am grateful to Prof. John Eriksson who has contributed with the drawings of the species, and to Prof. Åke Fridh for his revision of the Latin diagnoses. I also want to thank Miss Gunnel Johansson for her critical comments of the English text.

REFERENCES

Boidin,J. 1966. Basidiomycetes Corticiaceae de la République Centrafricaine I. Le genre Gloeocystidiellum Donk. Cahiers de La Maboké IV (1):5-17.

Boidin,J., Lanquetin,P. & Gilles,G. 1980. Application du concept biologique de l´espece aux basidiomycetes: Le genre Vararia (section Vararia) au Gabon. Cryptog. Mycol. I p. 279.

Eriksson,J. & Ryvarden,L. 1975. The Corticiaceae of North Europe. Vol. 3:404-443.

Hallenberg,N. 1980. New taxa of Corticiaceae from N. Iran. (Basidiomycetes). Mycotaxon 11:447-450.

Hjortstam,K. 1980. Notes on Corticiaceae (Basidiomycetes)VII. A synopsis of the genus Amylocorticium Pouz. Mycotaxon 11:430-434.

-"- 1983. Studies in Tropical Corticiaceae (Basidiomycetes) V. Specimens from East Africa, collected by L. Ryvarden. Mycotaxon 17:559-560.

Hjortstam,K. & Ryvarden,L. 1979. Notes on Corticiaceae (Basidiomycetes)IV. Mycotaxon 9:505-519.

Jülich,W. & Stalpers,J.A. 1980. The resupinate non-poroid Aphyllophorales of the temperate northern hemisphere. Ver.Kon.Nederl.Weten.Natuur. 2(74):222-224.

Liberta,A. 1980. Notes on the genus Subulicystidium. Mycotaxon 10:409-412.

Nakasone,K.K. 1982. Cultural and morphological studies of Gloeocystidiellum porosum and Gloeocystidiellum clavuligerum. Mycotaxon 14:316-324.

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EFFETIA, A NEW GENUS OF ASCOMYCETES FROM TROPICAL FOREST SOILS

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Summary

Effetia craspedoconidica gen. et sp. nov., probably to be included into the family Sordariaceae, is characterized by ostiolate dark perithecia, cylindrical asci, unitunicate and light brown ascospores. Virgariella-like conidial state, with conidia regularly surrounded by a gelatinous sheath is also described.

During some mycological investigations carried out by our working group within the Tai Project ("Effects of increasing of human activities on south-western Ivory Coast tropical rain forest", M.A.B. Programme, Project n° 1), we found among other microfungi, a strain not referable, for its conidial and perfect stage characters, to a described genus.

The first isolation of this strain is dated December 1976 and we refound it repeatedly, while studying additional soil samples from the same locality (March 1978, December 1978, January 1979, April 1979, May 1979, August 1979, October 1979 and January 1980). This strain has been reported as " Ascomycetes n° 1 " in " Comparative studies on microfungi in tropical ecosystems " (Rambelli et al. 1983).

In any case the strains always showed fertile perithecia only in the first transplant, despite any attempt to stimulate it in many different media.

The holotype is deposited in IMI Culture Collection under n° 223521, but as all the other isolates, it has lost the need and the ability to produce the teleomorphosis.

In this work the description of this Ascomycetes is reported and the institution of the new genus Effetia is proposed. This genus seems to be near the family Sordariaceae even if its Virgariella-like conidial state would be more characteristic of Xylariaceae.

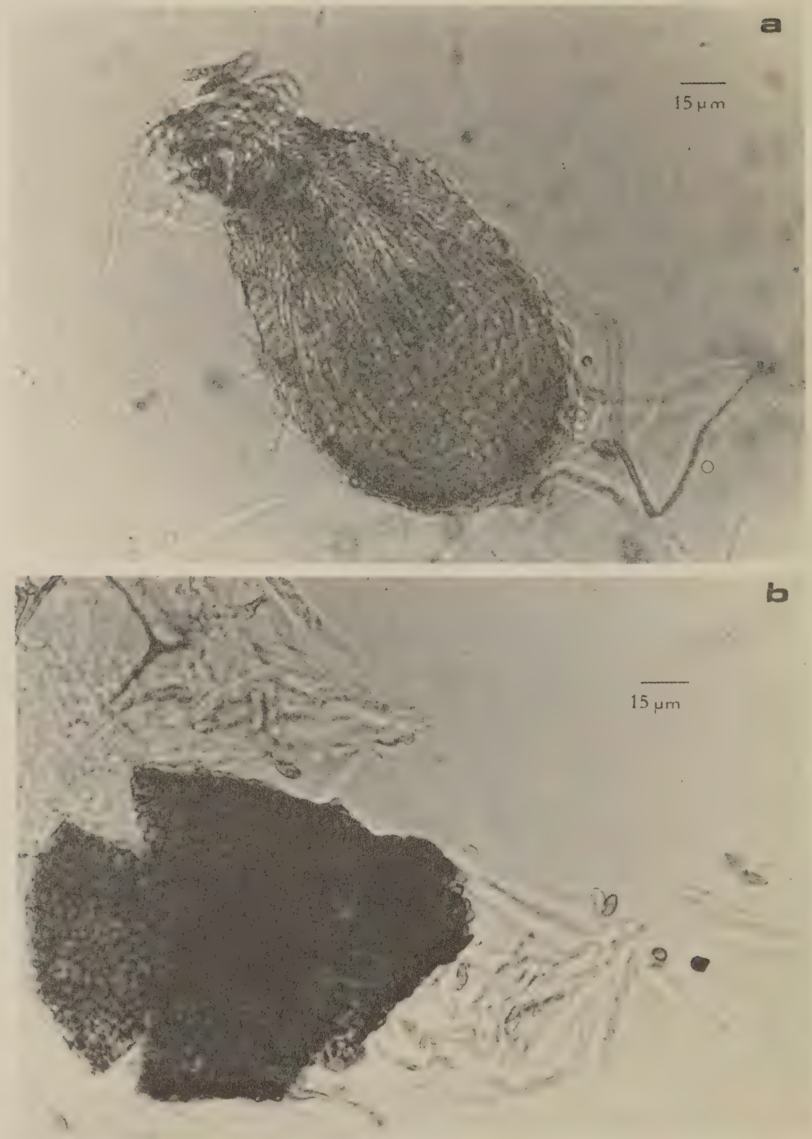

a
15 µm
b
15 µm

Fig. 1- a. young perithecium; b. perithecium and asci

Effetia Bartoli, Maggi et Persiani gen. nov.

Saprophila. Peritheciis sine stromate, solitariis, obscuris, glabris, subglobosis, collo brevi, crasso, ostiolato. Peridio membranaceo. Ascis octosporis unitunicatis, cylindraceis, apparatu apicali leviter crasso. Ascosporis unicellularibus, primum sine colore deinde leviter brunneis maturitate, ellipsoideis uno extremo poro germinali praeditis.
Anamorphosis: Virgariella-similis
Holotypus: Effetia craspedoconidica
(Etym. : Effetus = effete)

Saprophytic. Perithecia non stromatic, solitary, deep brown, glabrous, subglobose with a short, stout ostiolate neck. Perithecial peridium membranaceous. Asci eight-spored, unitunicate, cylindrical with a slightly distinguishable apical thickness. Ascospores unicellular, at first hyaline, then light brown with age, elliptical with a clearly distinguishable germ pore.
Anamorphosis: Virgariella-like
Holotype: Effetia craspedoconidica

Effetia craspedoconidica Bartoli, Maggi et Persiani sp. nov.

Coloniae in agaro extracto e solo lente crescentes, superficie laevi, brunnea vel atra, mycelio sine colore vel leviter brunneo, hyphis dimensionibus variabilibus, interdum in fasciculos confertos composito. Peritheciis brunneis, superficialibus, dispersis, 110-150 x 70-110 µm (130 x 95 µm), subglobosis vel pyriformis, glabris, ostiolatis cum crasso collo plus minusve brevi, 30 µm in diametro, usque ad 35-40 µm longo. Peridio peritheci tenui, membranaceo, cellulis forma atque dimensionibus variabilibus constituto: angulatis (10-10.8 x 12-13.5 µm) vel polygoniis (9-10 x 6-6.5 µm) vel linearibus (10-10.5 x 2-2.5 µm). Ascis octosporis, cylindraceis (54-65 x 4.5-5.5 µm), apparatu apicali indistincto vel leviter crasso praeditis, cum iodo non reagentibus. Paraphysibus absentibus. Ascosporis primum irregulariter in asco dispositis deinde oblique uniseriatis, unicellularibus, ellipsoideis (7-9 x 2.3-3.5 µm), primum biguttulatis atque sine colore deinde olivaceo-brunneis plerumque poro germinali praeditis.
Anamorphosis: conidiophora erecta, solitaria numquam ramulata, plus minusve rigida aliquando flexuosa, brunnea, enodia, plerumque 2 µm in diametro, attenuata ad apicem versus, 20-60 µm longa, longiora ubi protracta sicut saepe accidit, non determinata, ad regulam septata a basi per totam longitudinem. Cellulae conidiogenae polyblasticae, terminales deinde intercalares, inter regiones fertiles 12-28 µm, plerumque apicibus inflatis. Conidia acropleurogena, generata per conspicuos denticulos usque ad 1-1.2 µm longos, ellipsoidea, 0-septata, subhyalina vel leviter brunnea, enodia, 7.5-9 x 3.5-4 µm, apice rotundato, cicatrice plana ad basim praedita; strato mucoso hyalino vel subhyalino, 6-8 µm lato, interrupto apice atque basi praedita. Mycelio abundantibus chlamydosporis irregularibus forma atque di-

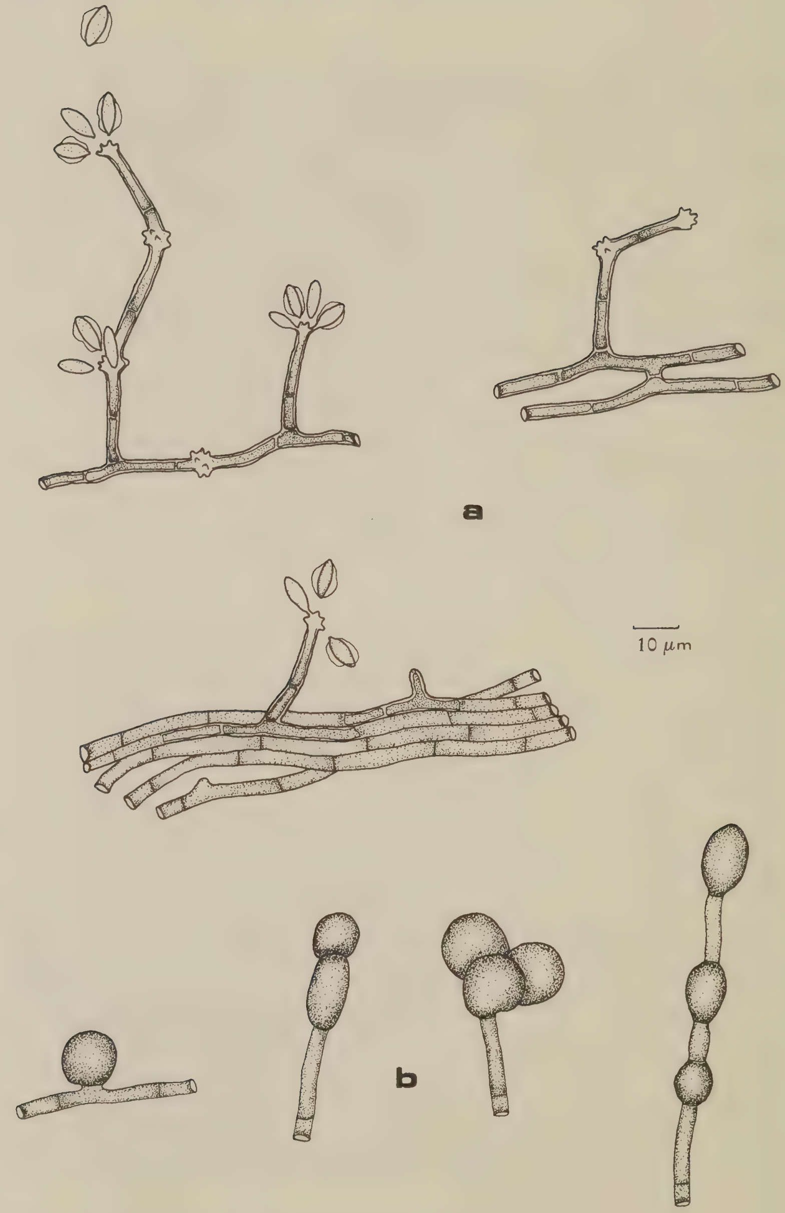


Fig. 2- a. conidial state b. chlamydospores.

mensionibus (9-16 x 8-18 µm), brunneis, parietibus crassis, singulis vel glomeratis vel in catenis praedito.
Habitat: e solo silvestri collecto in Tai, Ora Eboris, December 1976.
Typus: Horto Botanico Roma 105 S.

Colonies in soil extract agar growing restrictedly, consisting of a compact basal felt with a plane surface, brown or deep brown; mycelium from hyaline to brown, composed by hyphae variabile in dimensions sometimes in clusters. Perithecia scattered, developing superficially, brown, subglobose or pyriform, 110-150 x 70-110 µm (130 x 95 µm), glabrous, with an ostiolate neck up to 35-40 µm, usually 30 µm in diameter (fig. 1 a-b). Perithecial peridium not very thick, membranaceous, composed by cells of irregular shape and size: angular (10-10.8 x 12-13.5 µm) or polygonal (9-10 x 6-6.5 µm) or linear (10-10.5 x 2-2.5 µm). Asci eight-spored, cylindrical, 54-65 x 4.5-5.5 µm, with a barely visible or distinctly thickened apical apparatus, without amyloid portion. Paraphyses lacking. Ascospores at first irregularly disposed in the ascus, later oblique uniseriate, one celled, elliptical, 7-9 x 2.5-3.5 µm, biguttulate and hyaline at first, later olivaceous-brown, mainly with a well distinct germ pore.

Anamorphosis: conidiophores erect, unbranched, straight or flexuous, brown in colour, smooth, mostly 2 µm wide, narrowed toward the apex, variable in lenght from 20 to 60 µm, somewhat longer when the conidiophore is proliferating, as it often occurs (fig. 2a, fig. 3 b-c-d); indeterminate, regularly septated in proximity of the origin from the vegetative hyphae and all along the conidiophores.

Conidiogenous cells polyblastic, terminal ones becoming intercalary, sympodial ones proliferating with space 12-28 µm in lenght between the fertile regions, mainly swollen at the apex (fig. 3 b-c-d).

Conidia acropleurogenous, on a distinct denticle up to 1-1.2 µm, elliptical, 0-septata, subhyaline to light brown, smooth, 7.5-9.5 x 3.5-4 µm, rounded at the apex, with a basal scar corresponding to the points of attachment to the conidiogenous cells (fig. 4 c), regularly surrounded by a hyaline or subhyaline sheat stretched or wrinkled in appearance, measuring 6-8 µm in thickness, interrupted at the apex and at the base of the conidium (fig. 3 a).

Scanning electron microscope observations confirm sheat surrounding conidia to be gelatinous and continuous except at the apex and at the base (fig. 4 c-d).

The anamorphosis of Effetia closely resembles the Virgariella-type described by Jong and Roger (1972) for Xylariaceae, while the ascigerous state, with ostiolate dark perithecia, cilindrical asci, unitunicate and light brown ascospores, seems to be related to the family Sordariaceae. For some features, this strain could resemble an atypical member of Sordariaceae, like, on the other hand, other genera assigned to this family. In fact in Effetia an ascus apical apparatus is not present, as it is in Fimetariella Lundqvist and ascospores are unornamented like in Apodus Malloch & Cain.

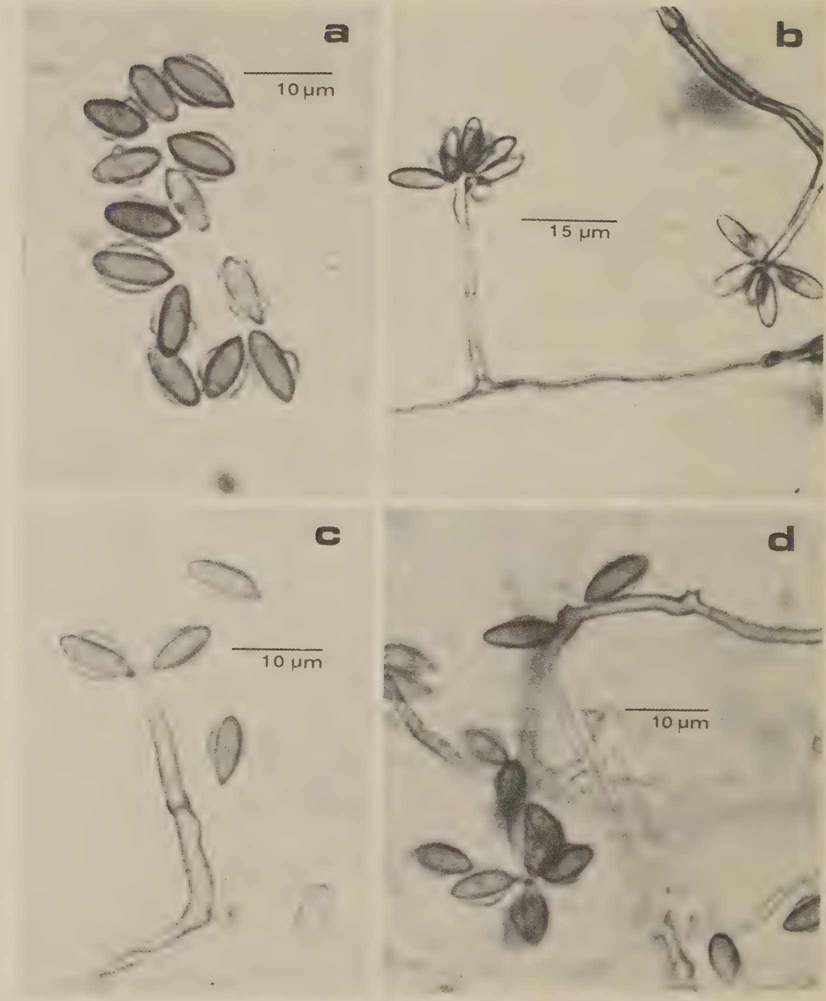
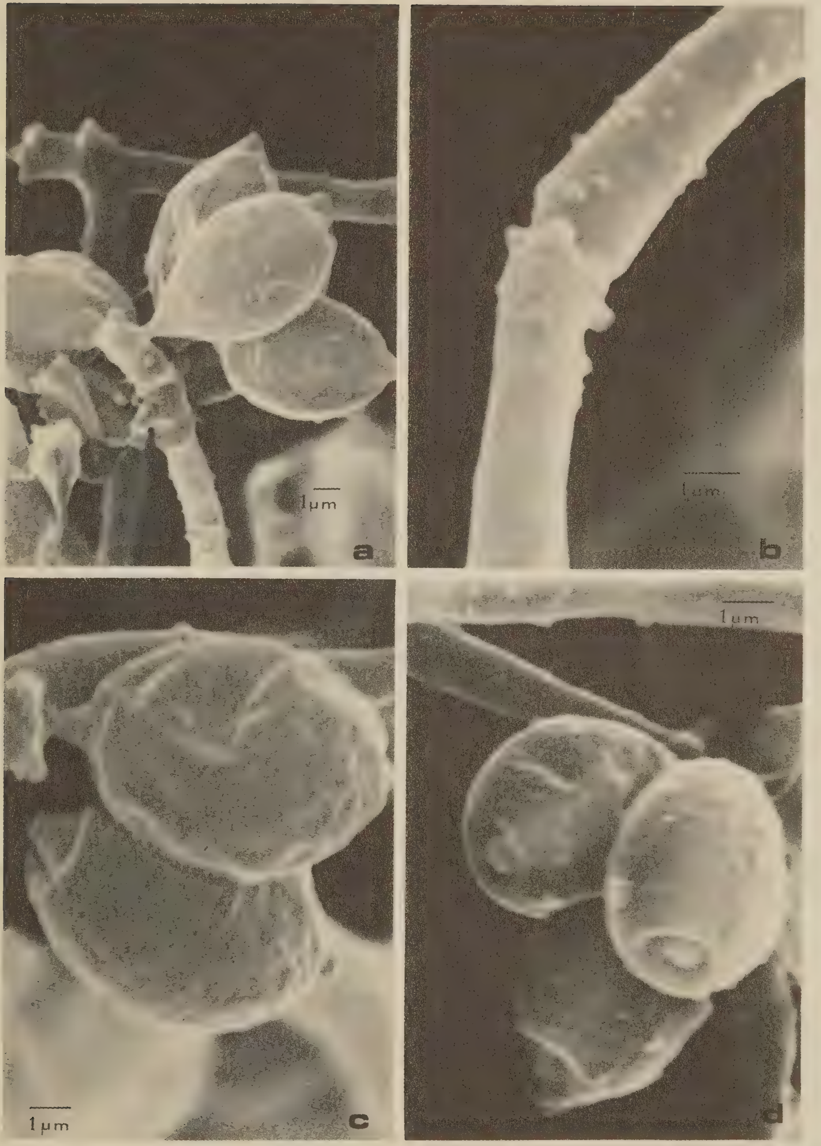

a
10 µm
b
15 µm
c
10 µm
d
10 µm

Fig. 3- a. conidia showing the typical gelatinous sheat; b-c. conidiophores and conidia; d. proliferating conidiophores showing distinct denticles.


1µm
a
1µm
b
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c
1µm
d

Fig. 4- a-c-d. conidiophores and conidia; b. denticles.

However, considering the real problems on the taxonomical position of this genus, we propose the inclusion of this fungus in the Sordariaceae family, leaving this point opened to further considerations.

ACKNOWLEDGEMENTS

The Authors wish to thank Dr. S. Onofri for scanning electron microscope photographs and all the working group for the friendly assistance and advices; the Minister of Scientific Research of the Ivory Coast for his kind assistance and the Technical and Scientific Cooperation Service of the Italian Foreign Office for its collaboration. We also thank Prof. Onorato Verona, Istituto di Microbiologia Agraria e Tecnica, Università di Pisa, Italy, for the review of the manuscript and Dr. Sutton of C.M.I. for his usefull criticism.

REFERENCES

Jong, S.C. and J.D. Rogers. 1972. Illustrations and descriptions of conidial states of some Hypoxylon species. Washington Agricultural Experiment Station. College of Agriculture, Washington State Univ.

Lundqvist, N. 1972. Nordic Sordariaceae s. lat. Acta Universitatis Upsaliensis. Symbolae Botanicae Upsalienses XX.

Rambelli, A., A.M. Persiani, O. Maggi, D. Lunghini, S. Onofri, S. Riess, G. Dowgiallo and G. Puppi. 1983. Comparative studies on microfungi in tropical ecosystems. Mycological studies in South Western Ivory Coast forest. Report n° 1 - M.A.B. - UNESCO Roma.

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RARE OR INTERESTING HYPHOMYCETES FROM TROPICAL FOREST LITTER

V. *DACTYLARIA FUSIFORMIS*. NOTES ON THE GENERIC CONCEPT OF *DACTYLARIA*

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Summary

In this paper a critical analysis of the limits of the genus *Dactylaria* Sacc. is carried out. The specific limits of *D. fusiformis* Shearer et Crane (1971) are also discussed. The first African record of this species is reported and its description and illustration are given. The combination *D. fusiformis* (Matsushima) de Hoog et von Arx (1973), is rejected as illegitimate.

During some mycological researches carried out by the Chair of Mycology of the University of Rome as part of the Tai Project (M.A.B. Program, UNESCO, Project n. 1) for the study of the influence of human activities in South-Western Ivory Coast forests, some specimens referable to the species *Dactylaria fusiformis* Shearer et Crane (1971) have been found in the litter. A further specimen has been found on fragments of leaves in the forest litter near Uxpanapa, Veracruz, México. The presence of this species has already been recorded in Maryland, USA (Shearer and Crane, 1971, holotypus), in Papua-New Guinea (Matsushima, 1971), in Japan (Matsushima, 1975), in Byelorussian SSR, URSS (Stefanovich and Halubkow, 1976) and also in Argentina (Gamundi et al., 1977). This is the first record in Africa and México.

Dactylaria fusiformis Shearer et Crane, 1971, *Mycologia* 63:243-244.

Colonies effuse, amphigenous, scarcely visible, uncircumscribed, pale brown. Mycelium immersed. Conidiophores macronematous, mononematous, erect, straight or slightly flexuous, solitary or in tufts of 2-3, simple or more rarely branched, smooth, thick-walled, septate, arising from immersed mycelium, light brown below, paler above; (36.5-)48-106(-140)x3-3.6 µm, 3.8-5.4 µm wide near the base. Conidiogenous cells polyblastic, integrate, terminal, sympodial, denticulate, thin-walled, hyaline, geniculate, inflated at the apex up to 10.8 µm wide; sometimes grow laterally just below the tip pushing the denticulate apex to one side and produce an other conidiogenous locus. Conidia dry, solitary or in small groups, fusiform to acerose, straight or slightly curved, (3-)4(-5) septate, rounded at the apex and slightly flat-cicatrized at the base, hyaline, thin-walled, radially disposed at the apex of the conidiogenous cell; 36-50x1.8-2.7 µm.

Specimens examined: H.B.R. 80A(1) on caulis of Oriza sativa in litter, Tai, Ivory Coast, 19.10.1979; H.B.R. 80A(2) on indet. leaves in forest litter, Tai, Ivory Coast, 19.10.1979; H.B.R. 80A(3) on indet. leaves in forest litter, Tai, Ivory Coast, 20.10.1979; H.B.R. 80A(4) on indet. leaves in forest litter, Tai, Ivory Coast, 20.10.1979; H.B.R. 80A(5) on indet. leaves in forest litter, Uxpanapa, Ver. México, 30.4.1982.

D.fusiformis was established by Shearer and Crane (10.3.1971), on the basis of a specimen isolated from balsa wood submerged in the fresh-water portion of the Patuxent River, Maryland, USA, 20.10.1967. These Authors describe for this species 3-septate conidia measuring 23.5-38x1.5-2 µm.

Shortly afterwards, Matsushima (September 1971) described under the name Mirandina typica a very similar fungus, whose conidia however measure 40-60x2-3 µm and are 3(-6)-septate (on rotten leaf of Castanopsis sp., Wan, Papua-New Guinea, 25.1.1970, MFC-2689).

Subsequently, Matsushima (1975) published the description of a new isolate of D.fusiformis (from rotten leaf of Ipomoea batatas var. edulis, Kagoshima City, Kagoshima, 12.1967, MFC-2231) having 3-4 septate conidia, 35-53x2-3 µm in dimensions and considers Mirandina typica Matsushima = Dactylaria fusiformis Shearer et Crane, nomen prius.

A further record for Argentina of the same species under the name Mirandina typica, was published by Gamundi et al. (1977); they described it as: "conidia 40-60x1.8-3 µm, multiseptados (frequentemente triseptados)".

As we can see, a lot of strains with the same general characteristics, but with slight differences in number of septa and dimensions of the conidia,in comparison with the holotypus, have been described under the name D.fusiformis (or under its synonym, M.typica).

Our strains can be included in this species, if we accept the minimum and maximum number of septa and the minimum and maximum dimensions of the conidia described by all the cited Authors, as limits for the species. To support this inclusion, we think necessary to amend the original diagnosis of D.fusiformis Shearer et Crane, concerning the number of septa and the dimension of the conidia, as follows: "Conidia ... 23.5-60x1.5-3 µm, 3-4(-6) septata".

The above mentioned synonymy between D.fusiformis and M.typica bring us to the more general topic of the probable synonymy between the genera Dactylaria and Mirandina Arnaud ex Matsushima (1975).

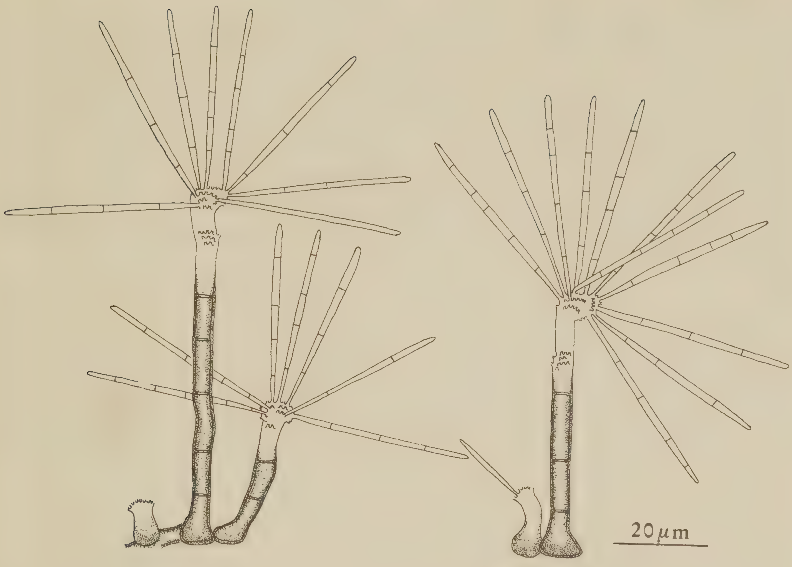

Fig. 1 - Dactylaria fusiformis Shearer et Crane

Sutton (1973) has already treated this topic declaring himself favourable to this synonymy. We need to make some preliminary considerations about the limits of the genus Dactylaria.

This genus was established by Saccardo (1880) with the type species D. purpurella (Sacc.) Sacc. (≡ Acrothecium purpurellum Sacc., 1877). Subsequently Bhatt and Kendrick (1968) proposed a synonymy between Diplorhinotrichum von Hönel, 1902, and Dactylaria, and amended the diagnosis of the latter, rightly including in it also the species with 1-septate spores, but excluding those species that have spores with more than 4 septa. These spores, however, were included in the diagnosis of Saccardo who described (1880): "conidia ... 2-pluriseptata". This reduction proposed by Bhatt and Kendrick of the maximum limits of the genus, contrary to the opinion of Sutton (1973), should lead to the exclusion from this genus of the species described in Mirandina. We think that it is advisable to modify the amended diagnosis of Dactylaria in order to include in it also species with several-septate conidia.

The genus Mirandina was established by Arnaud (1952) as nomen nudum and was subsequently validated by Matsushima, first with the publication of a Latin diagnosis (1971), and then with the designation (1975) of a type species. The establishment of this genus is justified by the need to keep species with the same morphological characteristics but with scolecospores separate from Dactylaria.

It is clear that without the insertion of the maximum limitation in the number of the septa of the spores, as proposed by Bhatt and Kendrick (1968), every species described in Mirandina could be included in Dactylaria. However we think that all known strains of the species D. fusiformis must anyway be included in Dactylaria having generally 3-4 septate spores and only exceptionally up to 6-septate ones.

It must moreover be noted that D. fusiformis is also a saprophytic species like D. purpurella. Schenck et al. (1977) have excluded all nematode-trapping species from Dactylaria, transferring these to Arthrobotrys Corda. Also if this concept is doubtful, Dactylaria is now restricted to the saprophytic species and D. fusiformis or the species described in Mirandina are assignable to Dactylaria.

A further consideration concerns the publication of the name M. typica Matsushima(1971) that was not valid, only because the genus Mirandina had not yet been validated by the designation of a type species. In fact Mirandina typica must be considered as facultative synonym and not an obligate one being the description of Matsushima based on a type which is different from the one of D. fusiformis.

Moreover we think that the illegitimacy proposed by Sutton (1973) on the basis of Art. 24 of the International Code of Botanical Nomenclature and reported in the Index of Fungi (Vol. 4, Part 4, 1972) is unjustified, because this Article says that the use of epithets such as typicus is inadmissible for infraspecific taxa but not for specific taxa, as in this case.

Let us now consider separately the new combination D. fusiformis (Matsushima) de Hoog et von Arx (1973) published for the species Scolecobasidium fusiforme Matsushima. These Authors, in a revision of Scolecobasidium Abbott, restrict this genus to those species included in it having Y - or T - shaped conidia. The other species are transferred into the new genus Ochroconis de Hoog et von Arx, if they have more or less cylindrical spores, or into the genus Dactylaria, if they have more or less fusiform or clavate spores. In fact Saccardo (1880) had already delimited to "conidia fusoidea v. clavulata" the shape of the conidia in Dactylaria. On the contrary, if the amended diagnosis of Dactylaria Sacc. emend. Bhatt et Kendrick, which also comprehends cylindrical conidia is considered valid, it will be necessary to propose a synonymy between Dactylaria and Ochroconis, maintaining for Scolecobasidium the limits assigned to it by de Hoog et von Arx (1973). But what is proposed by the latter Authors is not accepted by Ellis (1976) who considers Scolecobasidium and Ochroconis as synonyms and rejects the new combinations between Scolecobasidium and Dactylaria.

Because of the complexity of this problem we hope that further studies will be carried out to clarify the real limits of the above mentioned genera and their possible synonymy.

The combination D. fusiformis (Matsushima) de Hoog et von Arx for the species S. fusiforme is in any case illegitimate and must be rejected because the name is a later homonym of D. fusiformis Shearer et Crane (I.C.B.N., Art. 64).

Moreover, even if Matsushima does not mention the presence in S. fusiforme of denticles with the function of separating cells, a character he always excludes from his descriptions, such presence is clearly indicated in the illustration he published for this species. If the existence of separating cells is confirmed it will be necessary to transfer S. fusiforme to Pyricularia Sacc. and not to Dactylaria.

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The Authors wish to thank the Minister of Scientific Research of the Ivory Coast for the assistence he has given.They also wish to thank Prof. Angelo Rambelli, Dr. Oriana Maggi and Dr. Anna Maria Persiani for their criticism and Dr. Takashi Matsushima for his collaboration. They also wish to thank Prof. Onorato Verona, Istituto di Microbiologia Agraria e Tecnica, Università di Pisa, Italy, for kindly reviewing the manuscript.

REFERENCES

Arnaud, G. 1952. Mycologie concrète: Genera. Bull. Soc. mycol. Fr. 68:181-223

Bhatt, G.C. and W.B. Kendrick. 1968. The generic concepts of Diplorhinotrichum and Dactylaria, and a new species of Dactylaria from soil. Can. J. Bot. 46:1253-1257

De Hoog, G.S. and J.A. von Arx. 1973. Revision of Scolecobasidium and Pleurophragmium. Kavaka 1:55-60

Ellis, M.B. 1976. More Dematiaceous Hyphomycetes. Commonw. Mycol. Inst., Kew, Surrey, England.

Gamundi, I.J., A.M. Arambarri and A. Giaiotti. 1977. The microflora of litter of Nothofagus dombeyi. Darwiniana (B. Aires) 21(1): 81-114

Matsushima, T. 1971. Microfungi of the Solomon Islands and Papua-New Guinea. Kobe, Japan.

Matsushima, T. 1975. Icones microfungorum a Matsushima lectorum. Kobe, Japan.

Saccardo, P.A. 1877. Fungi italici autographice delineati. Michelia 1:73-100

Saccardo, P.A. 1880. Conspectus generum fungorum Italiae inferiorum. Michelia 2:1-135

Schenck, S., W.B. Kendrick and D. Pramer. 1977. A new nematode-trapping hyphomycete and a reevaluation of *Dactylaria* and *Arthrobotrys*. *Can.J.Bot*. 55:977-985

Shearer, C.A. and J.L. Crane. 1971. Fungi of the Chesapeake Bay and its tributaries. I. Patuxent River. *Mycologia* 63:237-260

Stefanovich, A.J. and U.U. Halubkow. 1976. New data on aquatic Hyphomycetes of the Byelorussian-SSR URSS. *Vyestsi Akad Navuk BSSR Syer Biyal Navuk* 5:110-113

Sutton, B.C. 1973. Hyphomycetes from Manitoba and Saskatchewan, Canada. *Mycol.Pap*. 132:1-143

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SPECIES OF HARPELLALES LIVING WITHIN THE GUTS OF AQUATIC DIPTERA LARVAE

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ABSTRACT

Five new fungal species belonging to the Legeriomycetaceae and Harpellaceae (Harpellales, Trichomycetes) are described from aquatic Diptera larvae: *Pennella arctica* and *Smittium pennelli* (from Simuliidae), and *Smittium alpinum, Stachylina penetralis*, and *Stachylina nana* (from Chironomidae). *Stachylina minuta* is validated, and *Smittium orthocladii* is emended to include the descriptions of zygospores and dimorphism in the trichospores.

It is abundantly evident that the Trichomycetes, fungi which live obligately in arthropod guts, are widely distributed around the world, and that a large number of taxa still remain to be discovered and studied. Many populations of midge larvae (Chironomidae), and perhaps most populations of blackfly larvae (Simuliidae), contain within their guts one or more species of Harpellales. Two of the fungal species whose descriptions follow are known from one locality only. The collection records of the others indicate a wider--and sometimes very disjunct--range. Regardless of the currently reported distribution, based on previous experience one can safely predict that most of the species described below will reveal themselves from time to time in other geographic regions as their arthropod hosts are collected and dissected.

The genus *Pennella* Manier *ex* Manier (Legeriomycetaceae) up to now has consisted of four species, known only from blackfly larvae. *Smittium* Poisson (Legeriomycetaceae) is a considerably larger genus, with 20 species from several dipteran families. *Stachylina* Léger & Gauthier (Harpellaceae) has 6 published species, all found attached to the peritrophic membrane of midge larvae. Zygospores are known in all of the *Pennella* spp., but in less than half of the *Smittium* spp. Zygospores of *Stachylina* spp. have not been reported.

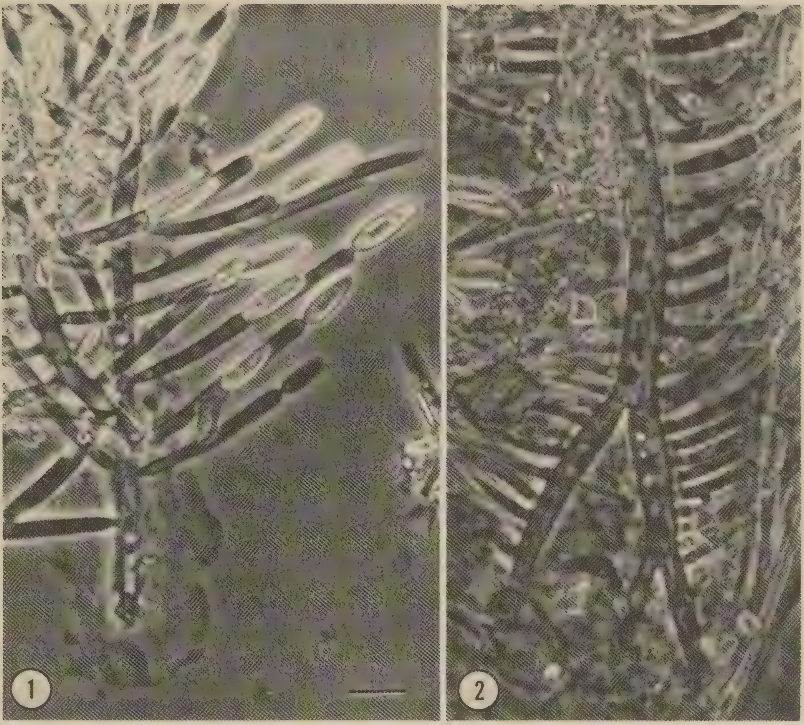
Pennella arctica Lichtwardt & Williams, sp. nov. Figs. 1-6

Thalli maturi 500 µm vel plus longitudine. Cellula coenocytica princeps basi profunde bifurcata, simplice, in substantia mucilaginea immersa, praedita. Trichosporae elongate obpyriformes, (40-)48(-58) x (8-)9(-11) µm, appendiculis tenuibus (2-)6(-7), collari nula, praeditae. Zygosporae (65-)70(-72) x 15-18 µm. Zygosporophori 35-40 x 13-20 µm. Proctodaei larvarum Simulidarum incola.

Mature thalli 500 µm or more in length, consisting of a large principal coenocytic cell whose base is simple to deeply and repeatedly bifurcate and embedded in a mucilaginous cementing substance. Trichospores long-obpyriform, (40-)48(-58) x (8-)9(-11) µm, with (2-)6(-7) fine appendages and no collar. Zygospores (65-)70(-72) x 15-18 µm, attached medially and parallel to the zygosporophores which measure 35-40 x 13-20 µm. In hindgut of Simuliidae (Diptera) larvae.

Holotype: Slide SWE-10-30 prepared from three hindguts of *Prosimulium ferrugineus* Wahlberg larvae, two containing thalli of *Pennella arctica* with trichospores; slide also contains *Paramoebidium* sp. thalli and trichospores of *Harpella melusinae* Léger & Duboscq. *Isotype:* Slide SWE-10-37 prepared from hindgut of *Prosimulium ferrugineus* larva containing thalli of *P. arctica* with trichospores and zygospores, and *Paramoebidium* sp. thalli. Types deposited with R. W. Lichtwardt, University of Kansas

Collections: Type locality: in *Prosiumulium ferrugineus* larvae from mouth of Abiskojåkka River where it drains into Lake Torneträsk, Abisko, Sweden, 10-VII-71. Montana, U.S.A.: in larval *Simulium (Eusimulium) baffinense* Twinn, 21-VI-82, and *Prosimulium exigens* Dyar & Shannon, 28-VI-82, from Big Creek, Ravalli Co.; in larval *Simulium arcticum*

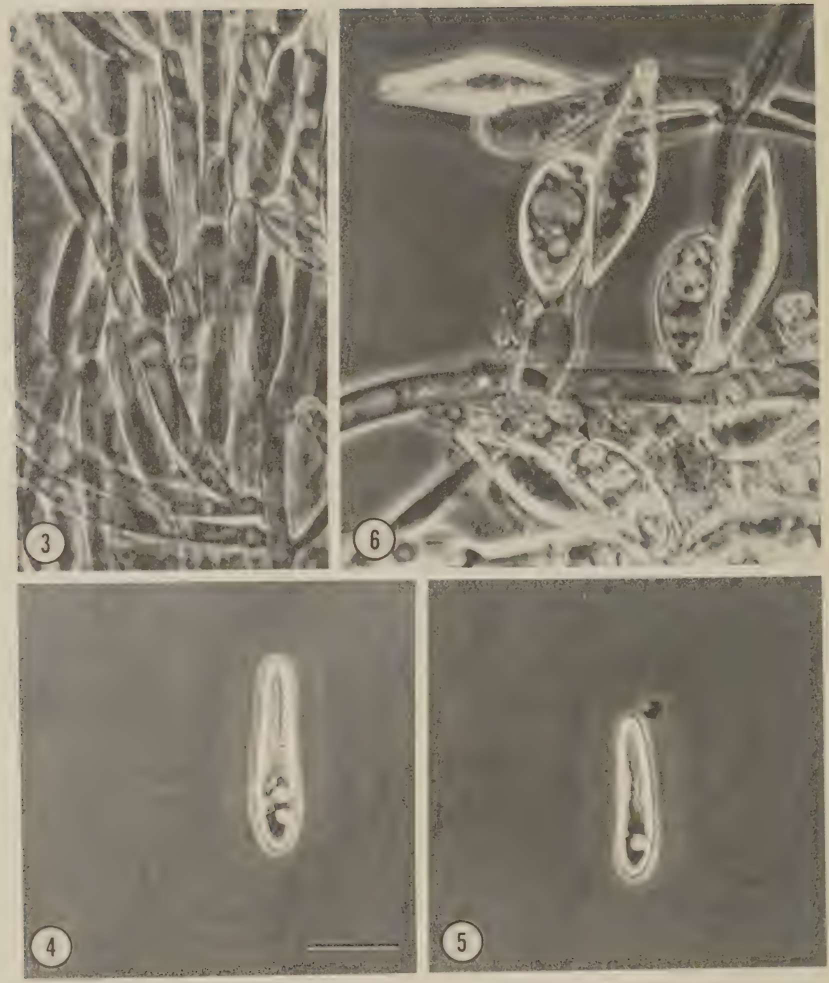


Figs. 1-2. *Pennella arctica*. 1. Thallus with immature trichospores, removed from its substrate; the basal cell is simple and has a wide zone of mucilage which cemented the thallus to the hindgut cuticle. 2. Doubly bifurcate, coenocytic basal cell with numerous lateral branches as seen within the hindgut. Bar = 25 μm for both figures.

Malloch, 21-VI-82, from unnamed creek crossing highway U.S. 93 at mile 70.5, Ravalli Co.

The Montana collections were made and studied with Dr. Marvin C. Williams, Kearney State College, Nebraska, with whom this species is jointly published.

The most unusual feature of the new species of *Pennella* is the variation found in the large, coenocytic basal cell of sporulating thalli: simple to dichotomously



Figs. 3–6. *Pennella arctica*. 3. Sporulating branches with trichospores attached to their generative cells. 4 and 5. Released collarless trichospores with multiple fine appendages; note the chains of prominent apical spore bodies within the upper half of the trichospores. 6. Biconical zygospores, not quite mature, attached medially to their rotund zygosporophores. Bar = 25 μm for all figures.

lobed to deeply and repeatedly bifurcate. Most trichospores develop from the numerous lateral branches of the basal cell, with relatively little or no sporulation occurring in the upper region of the thallus. In our Montana collections we sometimes found *Simuliomyces microsporus* Lichtwardt (Legeriomycetaceae) attached to the *Pennella* thalli.

The bifurcate thallial bases with their series of bilateral branches in the more developed thalli of *Pennella arctica* (Fig. 2) are similar to those of larger thalli of the type species, *P. hovassi* Manier *ex* Manier. (Fig. 25 in Lichtwardt, 1973, labelled *P. hovassi* is actually *P. arctica*.) These two species are similar in their general morphology, but *P. arctica* has considerably larger trichospores and somewhat shorter but wider zygospores.

The apical spore bodies of *P. arctica* (Figs. 4, 5) are quite prominent, as they typically are in *Pennella* spp. They are visibly present in mature trichospores of many other Harpellales, though often they are not as distinct. The apical spore bodies may function in germination and attachment of trichospores to the gut cuticle (see Moss and Lichtwardt, 1976; Williams, 1983).

Smittium pennelli Lichtwardt, sp. nov. Figs. 7-14

Thalli usque ad 300 μm longi, sparse ramosi, cellula basali ad acumen attenuata. Trichosporae in serie e 2-4 composita productae, elongate fusiforme-ellipsoidales, (31-)41(-55) x (6-)7(-8) μm, collare brevi rotundato 3.4-4 μm longo praeditae, terminales plerumque subapicaliter ortae. Zygosporae ignotae. Simuliidarum larvalium incola.

Thalli up to 300 μm long, sparsely branched, mucilaginous basal cell tapered to a point. Trichospores in series of 2-4, long fusiform-ellipsoidal, (31-)41(-55) x (6-)7(-8) μm, with a short rounded collar 3.4-4 μm long; terminal trichospores often produced subapically. Zygospores unknown. In larval Simuliidae.

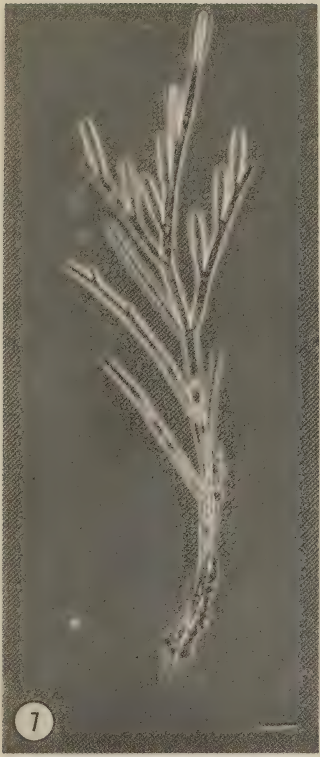
Holotype: Slide COL-39-18 prepared from gut of a *Simulium* sp. larva. The hindgut also contains another, conjugating Legeriomycetaceae, probably *Simuliomyces microsporus* Lichtwardt, and *Harpella melusinae* within the peritrophic membrane. Deposited with R. W. Lichtwardt, Univ. of Kansas.

Collections: Stream near Green Mountain trailhead, crossing route US 34, Rocky Mountain National Park, Colorado, U.S.A., 9-VIII-79 (type locality). The following all in Montana, U.S.A.: Johnson Creek, Lake Co. 18-VI-82 (*Prosimulium exigens* Dyar & Shannon, *P. onychodactylum* Dyar & Shannon); Truman Creek, Flathead Co., 19-VI-82 (*Simulium defoliarti* Stone & Peterson); Wolf Creek, Flathead Co., 8-VII-82 and 16-VII-82 (*Simulium defoliarti*); Payola Creek, Flathead Co., 10-VII-82 (*Prosimulium onychodactylum*). The collections in Montana were made with Dr. Marvin C. Williams.

Smittium pennelli currently is the only species of *Smittium* that attaches to the hindgut cuticle by means of a long basal cell which secretes a mucilaginous cementing substance along its entire length (Figs. 7-10). In this respect it resembles the genera *Pennella* and *Stipella* Léger & Gauthier, both of which also inhabit blackfly larva hindguts. The trichospores of *S. pennelli* are similar to those of *Smittium*, however, having a collar and a single appendage (Figs. 13, 14). *Smittium simulii* Lichtwardt is the other species of the genus which one commonly finds in Simuliidae larvae.

The dimensions and shape of the trichospores are sufficient to differentiate *S. pennelli* from other species of this largest genus of Harpellales. However, two other features are also distinguishing. One is the form of development of the trichospore on the terminal generative cell of fertile branches: the terminal trichospore usually grows not from the tip of the terminal generative cell, but rather laterally one-quarter to one-third down from the apex (Figs. 7, 9, 11, 12). In this way it somewhat resembles *Stachylina pedifer* Williams & Lichtwardt (Harpellaceae) (Lichtwardt & Williams, 1983). The other unusual feature is that in some thalli virtually all cells of the thallus may become reproductive (this development is present in the type slide). The only other *Smittium* reported to show this kind of reproduction is *S. cellaspora* Williams (1982).

Figs. 7-10. *Smittium pennelli*. 7. Entire small small sporulating thallus. 8. Tapered basal cell of a thallus showing the mucilagenous secretion with enveloped bacteria and debris. 9 and 10. A cluster of many individual thalli removed from the hindgut cuticle. Bars = 25 μm.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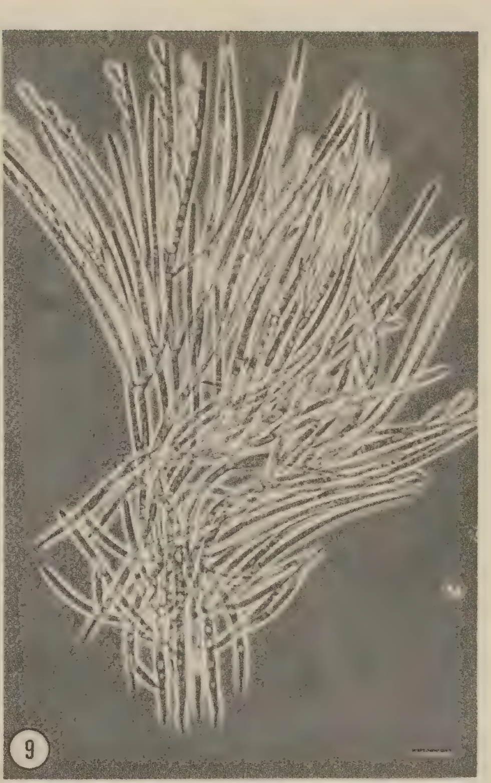
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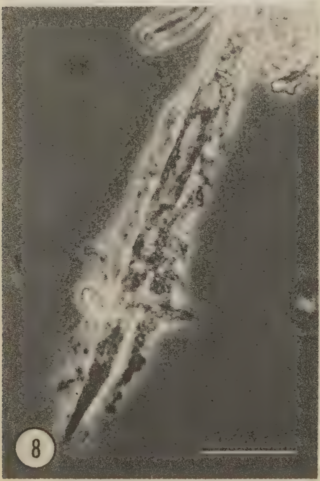
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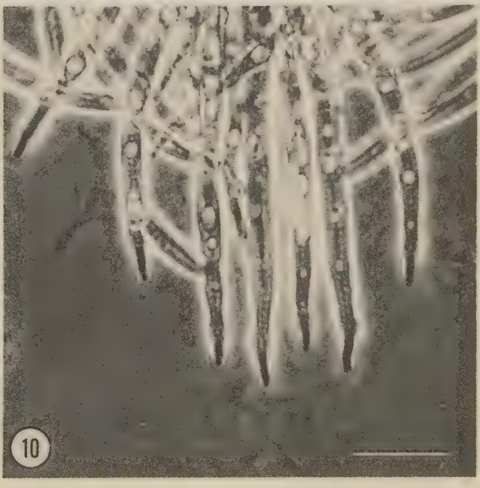
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Smittium alpinum Lichtwardt, sp. nov. Figs. 15-25

Thalli 1-3 cellulas genitales longas in ramo fertili omni producentes. Trichosporae ovales vel biconicae, (23-)33(-44) x (10-)12(-14) µm, collare cylindrico, (10-)14(-19) x (2-)3(-4) µm. Zygosporae biconicae, (63-)75(-83) x (14-)16(-18) µm, appendiculo unico et collare (15-)22(-28) x (4-)5(-7) µm ad latus juxta terminemunum zygosporae affixo praeditae. *Diamesae* spp. (Chironomidarum) larvalium proctodaei incola.

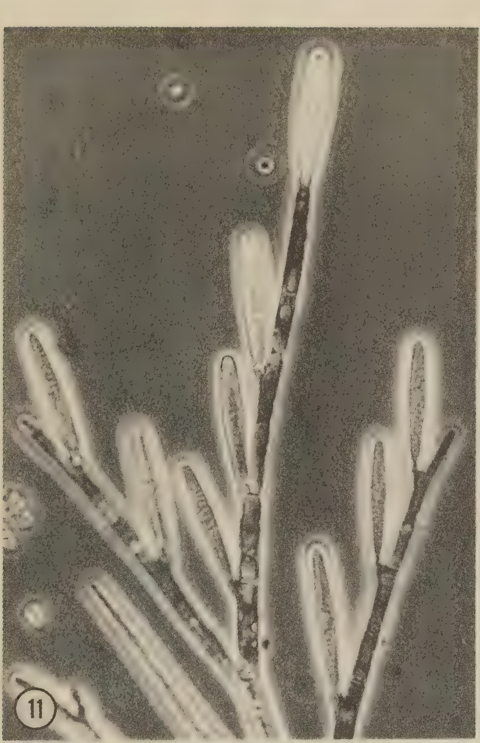
Thalli with 1-3 long generative cells per fertile branch. Trichospores oval to biconical, (23-)33(-44) x (10-)12(-14) µm, with a cylindrical collar (10-)14(-19) x (2-)3(-4) µm. Zygospores biconical, (63-)75(-83) x (14-)16(-18) µm with a single appendage and a collar (15-)22(-28) x (4-)5(-7) µm attached laterally near one end of the zygospore. In hindgut of larval *Diamesa* spp. (Chironomidae).

Holotype: Slide MBL-13-10 prepared from hindgut of a *Diamesa* sp. larva. Deposited with R. W. Lichtwardt, Univ. of Kansas.

Collections: Stream in wet meadow just below Logan Pass, Glacier National Park, U.S.A., 11-VIII-75 (type collection) and 26-VII-77; Lunch Creek, Glacier National Park, 11-VIII-75; stream along Ridonjira Trail following Abiskojåkka River near Abisko, Sweden, 6-VII-71; small stream draining into N shore of Lake Torneträsk, Sweden, 19-VII-71; small stream on route N 202 near Valloire, France (French Alps), 11-VII-68; small stream coming through a cave S of Brig, Switzerland (Swiss Alps), 11-VII-80; all in *Diamesa* spp. larvae.

The large oval to biconical trichospores with their long cylindrical collars distinshish *S. alpinum* from all other *Smittium* spp. The trichospores have a shape similar to *S. culicis* Manier trichospores, a species normally inhabiting mosquito larva hindguts, but those of *S. alpinum*

Figs. 11-14. *Smittium pennelli*. 11 and 12. Sporulating branches; note that most of the terminal trichospores are produced laterally and subapically on their generative cells. 13 and 14. Released trichospores, two of them germinating. Bar = 25 µm for all figures.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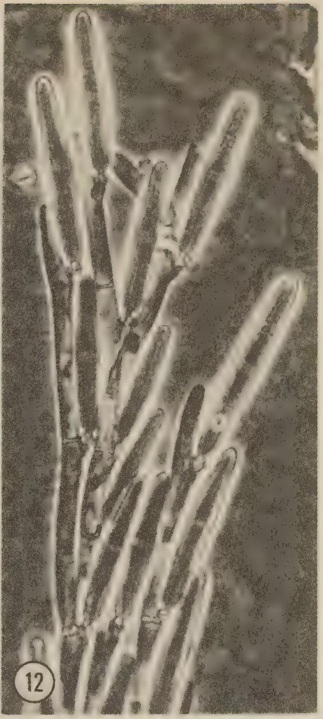
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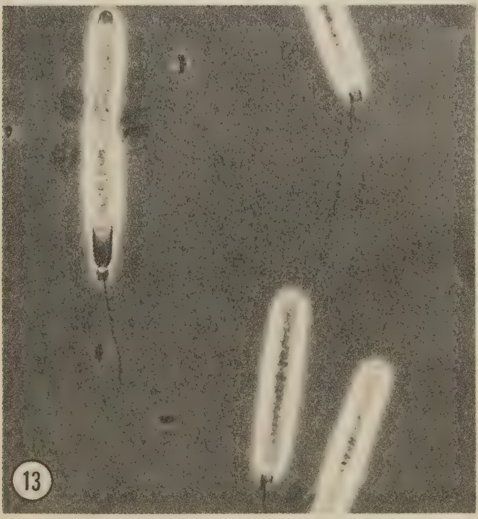
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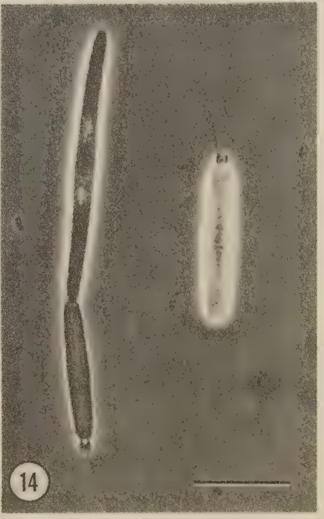
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are considerably larger. *Smittium alpinum* trichospores, though variable in size, are generally wider than trichospores of any other *Smittium* species. The long single appendage of *S. alpinum* trichospores often can be observed extending to the bottom of the long generative cell of unreleased trichospores. The zygospores of *S. alpinum* are also different in shape and size from all other *Smittium* species. They were found in the type locality and in specimens from Sweden.

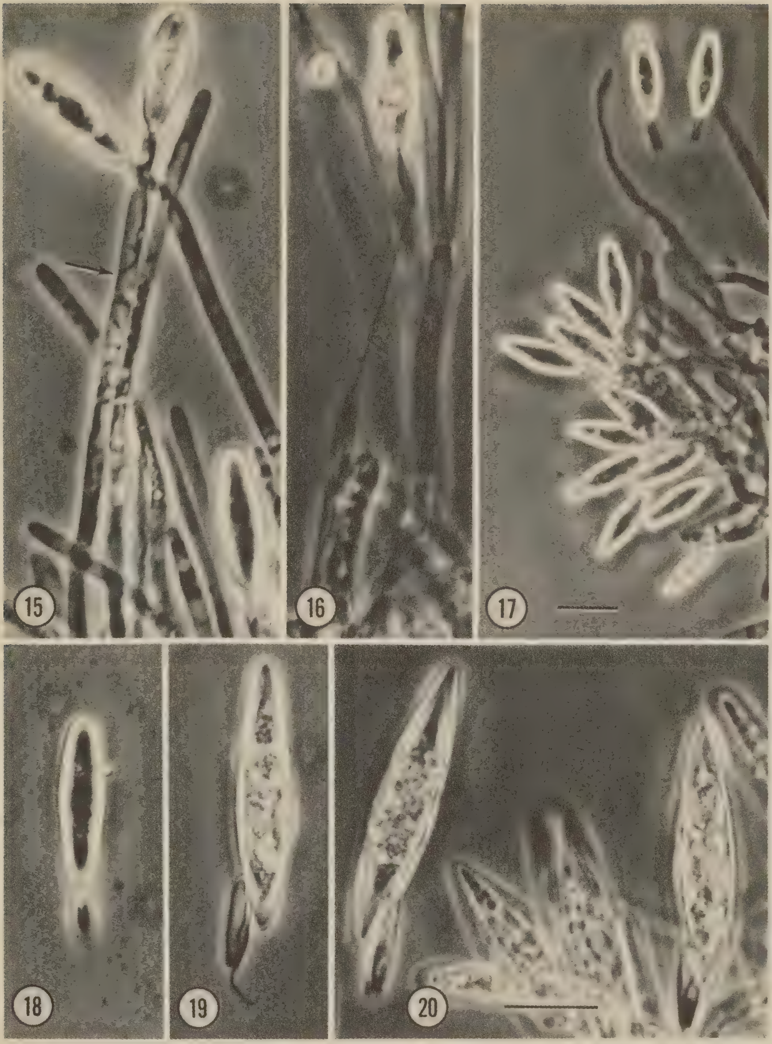
To date, *S. alpinum* is known to infest only *Diamesa* spp. larvae living in cold arctic or alpine streams. Some of the larvae collected below Logan Pass also were infested with *Smittium orthocladii,* whose emended description follows.

Smittium orthocladii Manier, 1969, emend. Lichtwardt
Figs. 26-31

Thalli compactly branched, with the basal branches of smaller thalli often fascicled and sometimes enveloped in a brownish gelatinous sheath. Fertile branches producing up to 10 trichospores. Trichospores long ellipsoidal with a slight median swelling, (25-)30(-36) x (6-)7(-8) µm, and a cylindrical collar 5-10 µm long, developing first as oval bodies which may not mature into the normal shape and which may detach as small, oval trichospores 8-10 x 5-6 µm with collars 5-10 µm long. Zygospores biconical but almost cylindrical in the middle, (81-)87(-98) x (9-)10(-11) µm, with a collar 12-18 µm long attached close to one end of the zygospore and bearing a single appendage. In larval Chironomidae (Diptera) hindguts.

The emended description provides the first information on the zygospores of *S. orthocladii*, and the presence of dimorphism in the trichospores.

Smittium orthocladii was first described as *Rubetella orthocladii* Manier & Mathiez (nom. nud.) in 1965, and later was validated by Manier in 1969 by citing a nomenclatural type, but she incorrectly called the name a new combination (the basionym was illegitimate). The name *Smittium orthocladii* was first used in an unpublished thesis by Coste-Mathiez (1970). The fungus was originally found attached to the hindgut cuticle of *Orthocladius* sp. larvae taken from an ephemeral stream in the Province of Hérault in

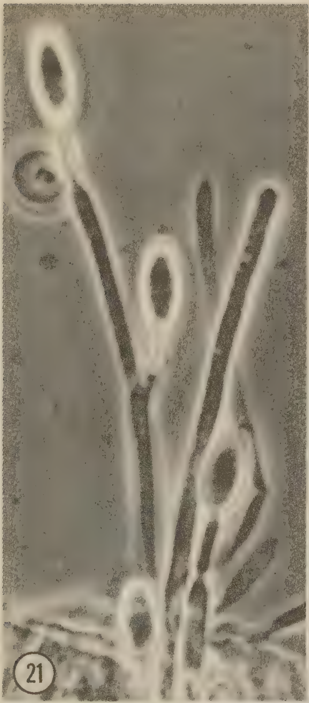


Figs. 15-20. *Smittium alpinum* from the type locality in Glacier National Park, U.S.A. 15. Trichospores; note the appendage (arrow) within one of the generative cells. 16 and 17. Trichospores, some released and showing a single trailing appendage. 18. An unusually long trichospore. 19 and 20. Zygospores. Bars = 25 µm; for unmarked photographs refer to bar in Fig. 20.

southern France. My collections are as follows: Stream in wet meadow just below Logan Pass, Glacier National Park, U.S.A., 11-VIII-75, in larval *Orthocladius* sp. and *Diamesa* sp. (Chironomidae); and in Doris Creek which drains into Hungry Horse Reservoir, Flathead Co., Montana, U.S.A., 29-VII-77, in unidentified Chironomidae larvae. The 1977 collections were made with Dr. Stephen T. Moss. Some of the *Diamesa* sp. larvae at the Logan Pass site were infested at the same time with *Smittium alpinum* described previously in this paper.

The occurrence of two trichospore sizes in *Smittium* species is unusual, but not unprecedented. *Smittium dimorphum* Lichtwardt & Williams (1983) was recently described as producing both oval and more elongate trichospores on the same thallus, as is the case with *S. orthocladii* (Figs. 26, 27). Manier and Mathiez (1965, their Fig. III, 1) actually illustrated series of oval trichospores very similar in appearance to my Fig. 26. They interpreted these to be younger developmental stages of the elongate trichospores. While it is true that young stages of trichospores in several *Smittium* species are initially oval, fertile branches of *S. orthocladii* with only oval trichospores do not develop further, and do not show the basipetal series of developmental stages one would expect to find in fertile branches producing more elongate trichospores. The oval spores frequently were found detached from their generative cells (Fig. 29), and one can only presume that they are functional propagules. I was not able to culture this species despite numerous attempts. Even if cultures had been successful, viability tests on the oval spores might not have been possible since most trichospores in currently available axenic cultures do not commonly germinate *in vitro*.

Figs. 21-25. *Smittium alpinum* from European localities. 21. Sporulating branches removed from a chironomid larva from northern Sweden. 22 and 23. Sporulating branches of the fungus from the Swiss Alps. 24 and 25. Trichospores from material collected in the French Alps, showing variation in spore size. Note that in Figs. 23 and 24 there are trichospores of another *Smittium* sp. which was also present in the hosts' hindguts. Bar = 25 µm for all figures.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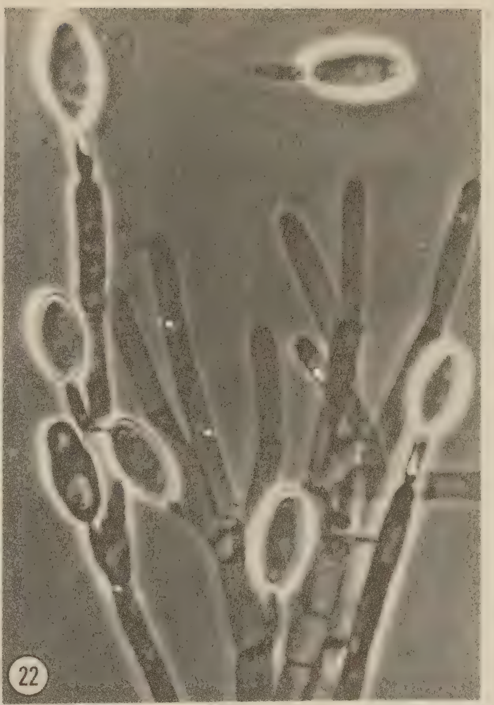
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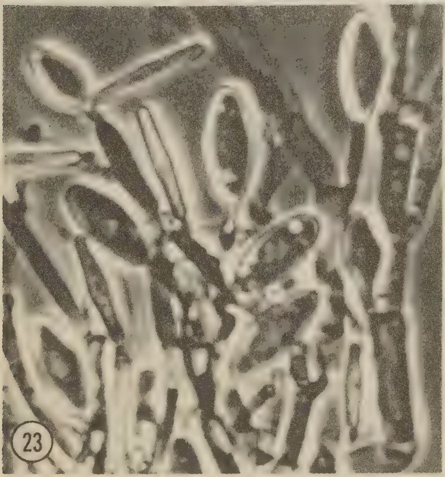
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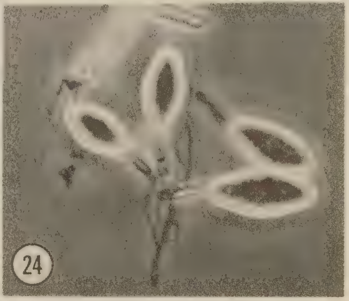
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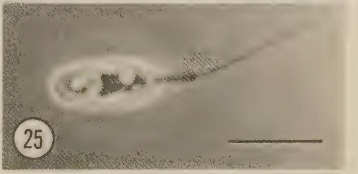
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The zygospores of *S. orthocladii* (Figs. 27, 30, 31) are typical of the kind found in many species of the genus. In *Smittium* they range from broadly biconical to narrowly biconical and almost cylindrical, as in *S. orthocladii*.

In my specimens the thallial branches were not as tightly fascicled near the base as described by Manier and Mathiez (1965), nor did I see a brownish sheath enveloping the base which the French authors described in some of the thalli they saw. Nevertheless, the other features presented above leave little doubt that the North American and French species are the same.

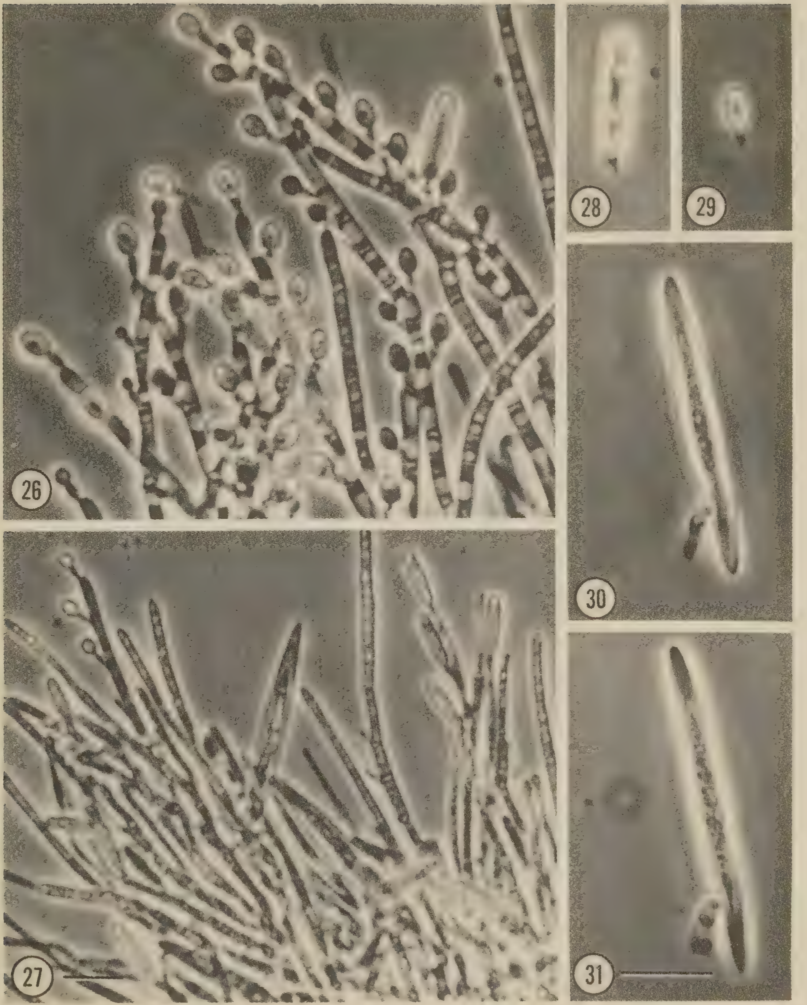
Stachylina minuta Gauthier *ex* Lichtwardt, sp. nov. Fig. 32

Thalli fusiformes 30-55 μm longi, 5-6 μm diametro, a basi bulbosa membranam peritrophicam penetrante affixi, trichosporas 1-4 gignentes; cellula terminali sterili. Trichosporae ellipsoidales, 15-16 x 5-6 μm, in prolongatione cellulae genitalis stricta cylindrica productae, disjunctae appendicula unica brevi, collari nullo praeditae. Zygosporae ignotae. Ad membranam peritrophicam larvarum Tanytarsinorum (Dipterorum, Chironomidarum) affixi.

Fusiform thalli 30-55 μm long by 5-6 μm diam, attached by a bulbous base which penetrates the peritrophic membrane, bearing 1-4 trichospores; terminal cell sterile. Trichospores ellipsoidal, 15-16 x 5-6 μm, produced on a narrow cylindrical outgrowth from the generative cell, upon detachment having a single short appendage and no collar. Zygospores unknown. Attached to peritrophic membrane of larval Tanytarsini (Diptera, Chironomidae).

Holotype: Figs. 1-15 in Gauthier, 1961, p. 3; reproduced as Fig. 32 herein.

This validates a distinctive species of *Stachylina* described by Gauthier, who did not provide a Latin diagnosis or cite a nomenclatural type. She found this fungus in the midgut of Tanytarsini larvae collected in small streams around Grenoble, France. It apparently has not been collected since the original discovery, despite two reports: Lichtwardt (1973) and Moss (1979), on the basis of the thallial penetration of the peritrophic membrane, gave the



Figs. 26-31. *Smittium orthocladii*. 26. Series of oval trichospores and one developing elongate trichospore. 27. Two trichospore types and one zygospore produced on a mass of thallial branches. 28. Detached elongate trichospore. 29. Detached oval trichospore. 30 and 31. Detached zygospores. Bars = 25 μm; for unmarked photographs refer to bar in Fig. 31.

name *S. minuta* to what are other species of *Stachylina* (Lichtwardt's is *S. penetralis*, whose description follows).

In addition to the small thallus size, two features readily distinguish *S. minuta* from other species of the genus: it is the only species to have a sterile terminal cell or compartment, and to produce its trichospores on a long, narrow outgrowth from the generative cell. A third feature, one that *S. minuta* shares with *S. penetralis* and *S. pedifer*, is the attachment of the thallus by a base which penetrates the host's peritrophic membrane (see Fig. 32). Gauthier did not describe such a penetration in the text of her article (in fact, she described it as attached *on* the membrane), but her illustrations would indicate otherwise. When the cylindrical peritrophic membranes of chironomid larvae are mounted in microscope slide preparations, thalli lie within the perfectly transparent membrane. Penetration by the thallial bases of those few *Stachylina* spp. which do penetrate is not readily evident to the unsuspecting observer, unless the thalli happen to lie along the very edge of the flattened membrane, as in the first two of Gauthier's figures (see Fig. 32). The bulbous base of *S. minuta*, without a secreted holdfast, is similar and conforms to what is clearly penetration in *S. penetralis*.

Gauthier also illustrated and described the thalli as being strongly recurved at the base. However, I believe this may be an artifact brought about by a twisting or rolling of the peritrophic membrane on the microscope slide. I have seen this phenomenon on a number of occasions, especially in species with narrow-based thalli; in these instances the thalli often can be straightened (at least in water mounts) if the coverslip is properly manipulated.

Stachylina penetralis Lichtwardt, sp. nov. Figs. 33-35

Thalli 70-180 x 8-10 µm, a basi bulbosa membranam peritrophicam penetrante affixi, trichosporas (2-)4-12 elongato-ellipsoidales 30-50 x 8-12 µm, appendicula unica et collari nullo praeditas, gignentes. Zygosporae ignotae. Ad membranan peritrophicam larvarum Diamesinarum (Dipterorum, Chironomidarum) affixi.

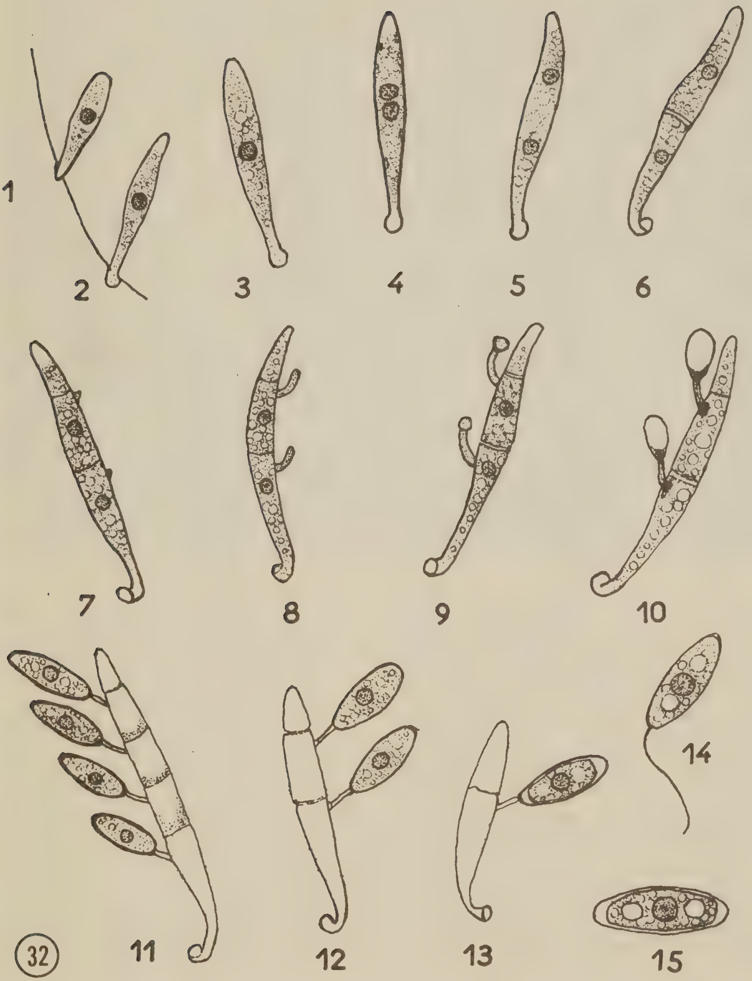


Fig. 32. Holotype of *Stachylina minuta* based on Gauthier's (1961) Figs. 1-15. Note the second figure; and in other figures the non-nucleated terminal cell or compartment which does not produce a trichospore. The twisted or recurved bases of the more mature thalli may be an artifact.

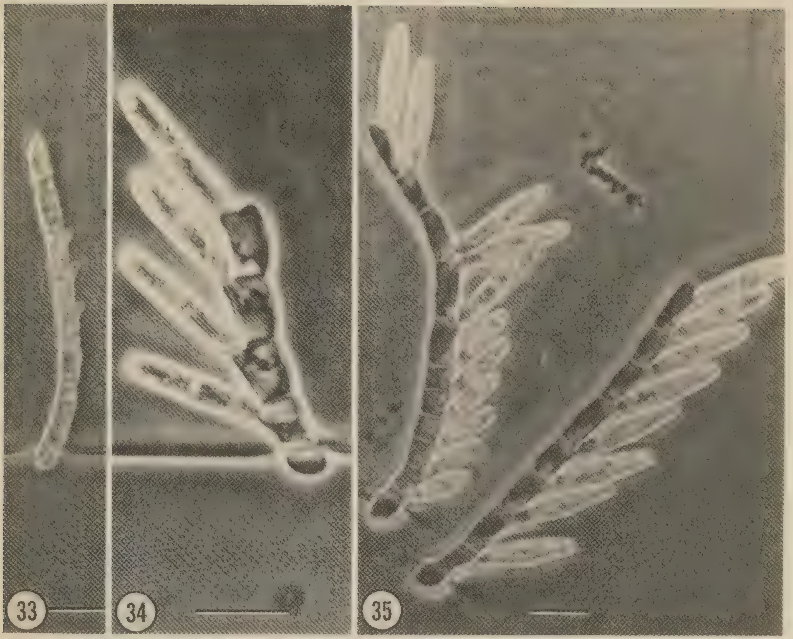
Thalli 70-180 x 8-10 µm, attached by a bulbous base which penetrates the peritrophic membrane. Producing (2-)4-12 long-ellipsoidal trichospores, 30-50 x 8-12 µm, with a single appendage and no collar. Zygospores unknown. Attached to peritrophic membrane of larval Diamesinae (Diptera, Chironomidae).

Holotype: Slide JAP-60-1 prepared from peritrophic membrane of a *Diamesa* sp. larva. Deposited with R. W. Lichtwardt, University of Kansas.

Collections: From larvae attached to side of cold, spring-fed water tank on Mt. Iwaki road, Aomori Prefecture, Honshu, Japan, 21-VI-67 (type locality); waterfall near Nakano Shrine, Lake Towada region, Honshu, Japan, 22-VI-67. Possibly also in a small stream on route N 202 near Valloire, France, 11-VII-68 (same site and host species as *Smittium alpinum*); and in Mattervasp River ½ km S of St. Niklaus, Switzerland, 11-VII-80. All in *Diamesa* sp. larvae.

Stachylina penetralis is the third species of the genus to be described as penetrating the peritrophic membrane of midge larvae, the other two being *S. minuta* and *S. pedifer*. The bulbous base of *S. penetralis* resembles that of *S. minuta*, but the species is morphologically more similar to *S. pedifer*. The latter species has shorter and more oval spores, and the penetrating thallial base has a footlike shape. Coste-Mathiez (1970) and Manier and Coste (1971) assigned, with some hesitation, the name *Stachylina macrospora* Léger & Gauthier to a fungus they found in midge larvae (*Syncricotopus rufiventris* Meig.) in southern France. Their fungus differs from *S. macrospora*--and *S. penetralis*--in thallus length (75-100 µm) and trichospore dimensions (about 25-30 x 8 µm), but it has a bulbous base that penetrates the peritrophic membrane, and is remarkably similar in this respect to *S. penetralis*. Other species of *Stachylina* attach to the peritrophic membrane by means of a small secreted holdfast, as in *S. nana* which follows.

Stachylina penetralis was illustrated by Lichtwardt (1973, Fig. 26) under the name *S. minuta*, which it clearly is not. The author has collected what may have been young thalli of *S. penetralis* in several other geographic regions. The sporulating collections from France and Switzerland, listed above, are probably this species, though the thalli and trichospores were slightly wider than

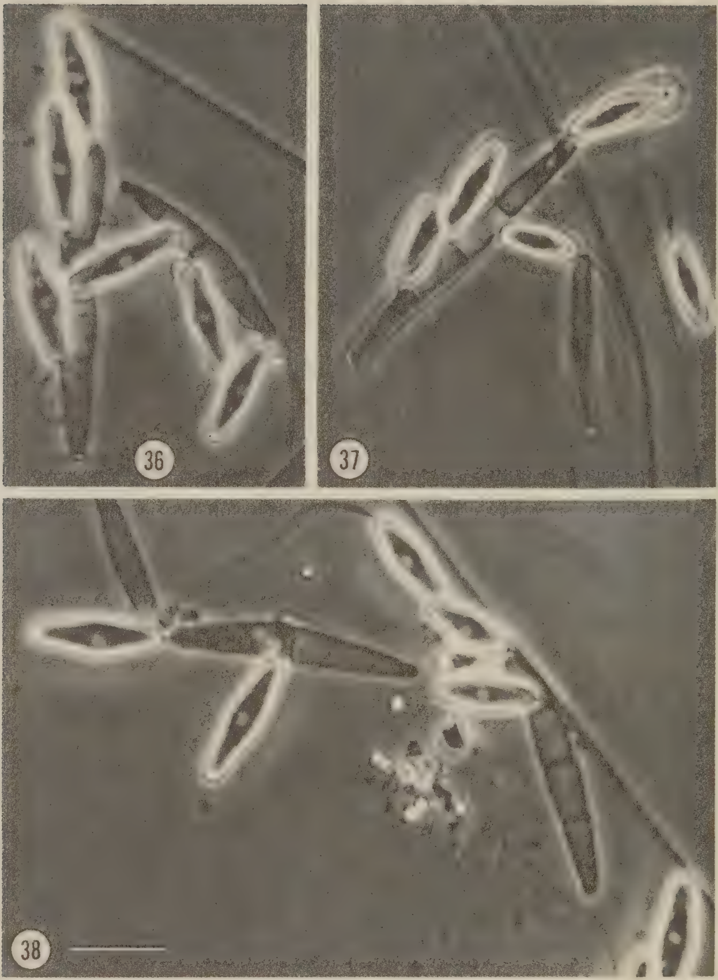


Figs. 33-35. *Stachylina penetralis*. Young, non-sporulating thallus lying within a peritrophic membrane, with its base penetrating through the membrane. 34. Four-spored thallus (reproduced, with permission, from Mycologia 65: 16). 35. Eight- and 11-spored thalli from type specimen; the folds in the membrane at the base of the two thalli indicate where the bases have penetrated. Bars = 25 µm.

those from the collections in Japan which are illustrated in Figs. 33-35 and on which the formal description of the species is based.

Stachylina nana Lichtwardt, sp. nov. Figs. 36-38

Thalli cymbiformes vel fusiformes, 60-80 x 8-10 µm, disco retinaculari, parvo ad membranam peritrophicam affixi, 2-4 trichosporas ovales vel biconicas (25-)30(-40) x (7-)8.5(-10) µm, appendicula unica, collari nullo



Figs. 36–38. *Stachylina nana*, showing 2- and 4-spored thalli, some with released trichospores. Note the small holdfast disk in Fig. 36. Bar = 25 µm for all figures.

praeditas, gignentes. Zygosporae ignotae. Ad membranam peritrophicam larvarum Chironomidarum (Dipterorum) affixi.

Thalli cymbiform to fusiform, 60-80 μm, attached to peritrophic membrane by a small holdfast disk. Producing 2-4 oval to biconical trichospores, (25-)30(-40) x (7-)8.5 (10) μm, with a single appendage and no collar. Zygospores unknown. Attached to peritrophic membrane of larval Chironomidae (Diptera).

Holotype: Slide FRA-103-5 prepared from several unidentified midge larvae (Chironomidae), one peritrophic membrane containing many thalli of *S. nana*. Deposited with R. W. Lichtwardt, University of Kansas.

Collections: From unidentified Chironomidae larvae (probably more than one species) living in the Dranse River E of Thonon-les-Bains near Lake Léman, France, 7-VIII-71.

The small thalli, few trichospores, and trichospore shape and size distinguish *S. nana* from other *Stachylina* species. The long trichospore appendage is generally flat and ribbonlike near the trichospore body, but tapers to become a very fine structure at the free end.

ACKNOWLEDGMENTS

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LITERATURE CITED

Coste-Mathiez, F. 1970. Parasites de larves de Chironomides (Diptères,,Nematocères) des environs de Montpellier. Thesis, Université de Montpellier.

Gauthier, M. 1961. Une nouvelle espèce de *Stachylina: St. minuta* n. sp., parasite des larves de Chironomides Tanytarsiens. Trav. Lab. Hydrobiol. Piscic. Univ. Grenoble 52, 53: 1-4 (1960-1961).

Lichtwardt, R. W. 1973. The Trichomycetes: what are their relationships? Mycologia 65: 1-20.

Lichtwardt, R. W., and M. C. Williams. 1983. Two unusual Trichomycetes in an aquatic midge larva. Mycologia: 75: 728-734.

Manier, J.-F., and F. Coste: 1971. Trichomycètes Harpellales de larves de Diptères Chironomidae: création de cinq nouvelles espèces. Bull. Soc. Mycol. France 87: 91-99.

Manier, J.-F., and F. Mathiez. 1965. Deux Trichomycètes Harpellales Génistellacées, parasites de larves de Chironomides. Ann. Sci. Nat., Bot., Ser. 12, 6: 183-196.

Moss, S. T. 1979. Commensalism of the Trichomycetes, pp. 175-227. *In* (L. R. Batra, ed.) Insect-fungus symbiosis. Nutrition, mutualism, and commensalism. Allanheld, Osmun & Co., Montclair.

Moss, S. T., and R. W. Lichtwardt. 1976. Development of trichospores and their appendages in *Genistellospora homothallica* and other Harpellales and fine-structural evidence for the sporangial nature of trichospores. Canad. J. Bot. 54: 2346-2364.

Williams, M. C. 1982. *Smittium cellaspora*, a new Harpellales (Trichomycetes) from a chironomid hindgut. Mycotaxon 16: 183-186.

Williams, M. C. 1983. Zygospores in *Smittium culisetae* (Trichomycetes) and observations on trichospore germination. Mycologia 75: 251-256.

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Page 46, line 4: for *A. apis* read *Ascosphaera apis*

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